INSTRUCTION BOOK

FOR

32V-3 AMATEUR TRANSMITTER

Manufactured by

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA

Burbank, Calif.
Dallas, Texas
New York, N. Y.

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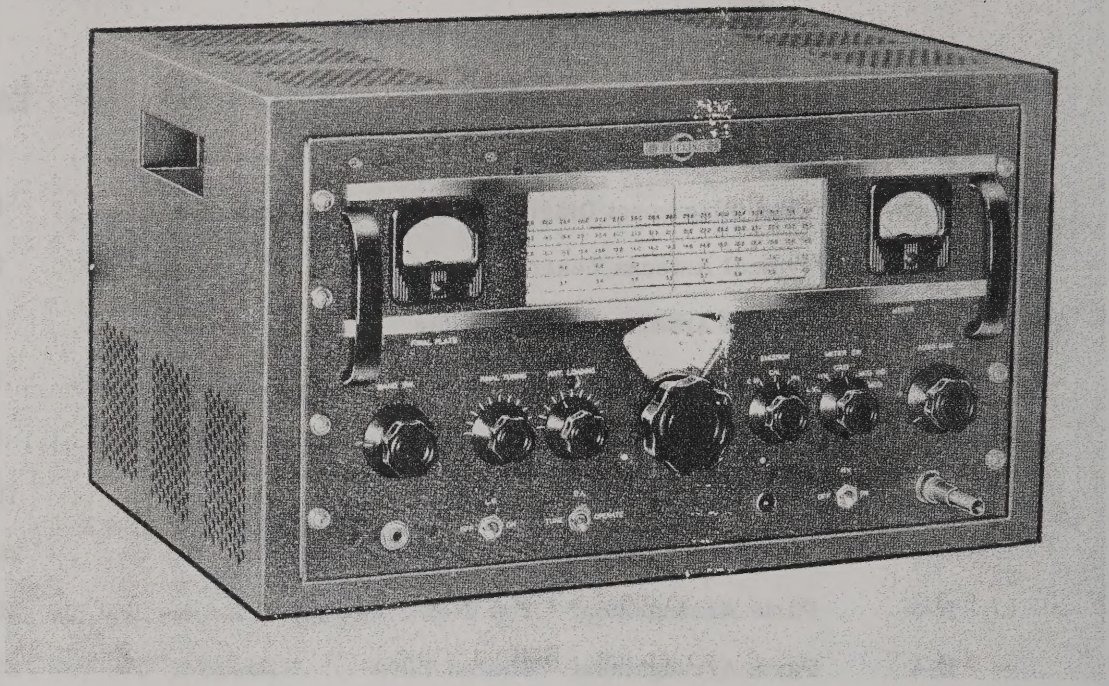


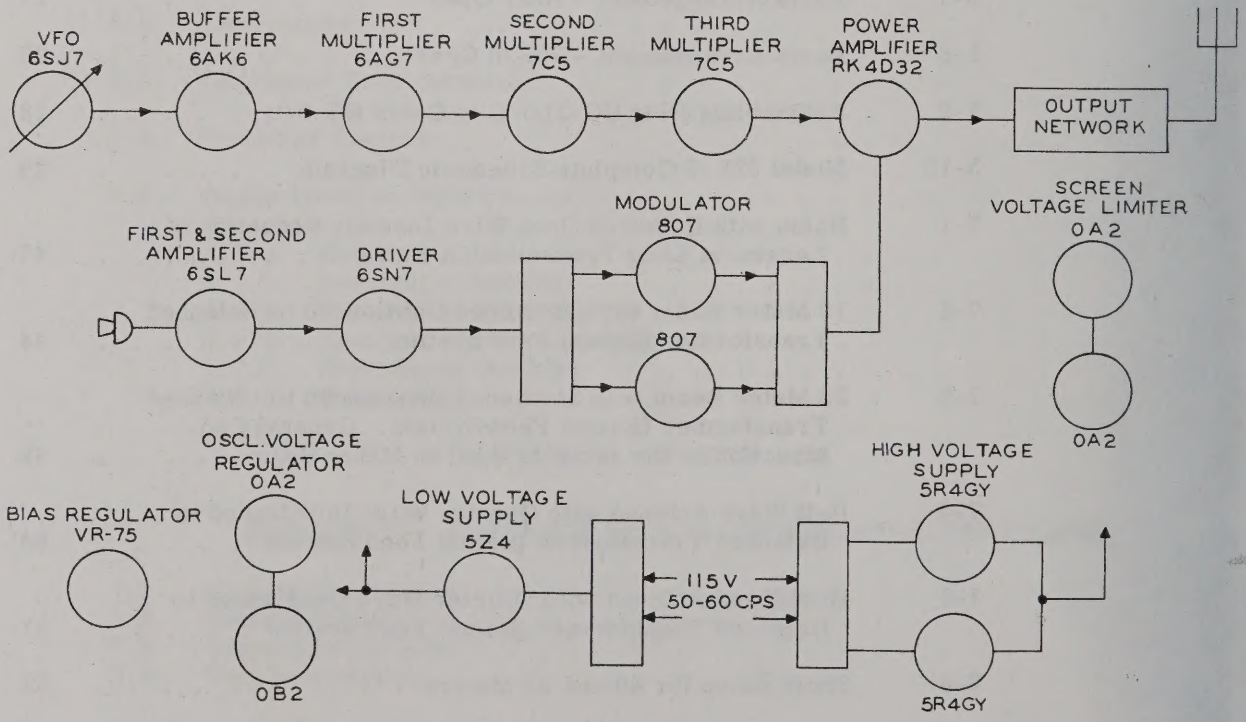


Figure 1-1 Model 32V Amateur Transmitter

SECTION I

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. This instruction book describes the installation, operation, and maintenance of the Collins 32V-3 amateur transmitter.

The type 32V-3 transmitter is a small, compact, VFO controlled unit featuring complete bandswitching and is capable of CW and phone operation on all amateur bands between 3.5 and 29.7 megacycles. Final plate power input of 120 watts phone and up to 150 watts CW is possible. Extra shielding and filtering is employed to minimize possibility of interference to other services. In fringe areas where television signals are very weak, certain installations may experience interference. In this event a low-pass filter such as the Collins Model 35C-2 should be installed in the antenna lead at the transmitter. Installation of a high-pass filter in the television receiver antenna lead may prove helpful.

The 32V-3 transmitter is designed for table mounting. The complete transmitter is housed in a single cabinet 21-1/8" wide, 12-1/4" high and 13-13/16" deep and weighs approximately 110 lbs. Openings are provided to assure adequate ventilation for all heat producing elements.

Transmitter components are divided into the five units named below:

70E-8B Oscillator
R-F Unit
Output Network
Speech Amplifier and Modulator
Power Supply

All wiring is independent of the cabinet, and the complete unit may be removed from the cabinet for inspection or maintenance.

Complete coverage of the 80, 40, 20, 15, 11 and 10 meter bands is obtained with the 32V-3. Quick band-change on all stages is accomplished by bandswitching. Tuning controls of the permeability tuned circuits of the 1st, 2nd and 3rd multipliers are ganged with the oscillator. The final tank consists of impedance matching network with two separate controls located on the front panel, one for tuning and one for loading.

Two heavy duty toggle switches control the low voltage and high voltage circuits. The switches are so arranged that the high voltage cannot be applied until the low voltage circuits have been energized. For convenience in applying high voltage, a push-to-talk switch associated with the microphone may be used instead of the HV toggle switch.

A meter selector switch on the front panel enables the operator to meter all important circuits of the transmitter. This switch can be rotated to five different positions. Each position inserts a meter into the selected circuit to be metered. A separate meter reads FINAL AMPLIFIER plate current only. The CW-CAL-PH switch is used to select the type of emission desired and to calibrate the accuracy of the dial reading against a known standard frequency. In the CW position, the modulator is disabled and the master oscillator operates continuously with the HV switch on. In the "CAL" position a signal of strength suitable for zero-beating with incoming signals may be heard in the associated receiver without operation of the final amplifier. On phone position, the key is closed and the modulator is operative. Keying is accomplished by means of grid block keying of the buffer stages. This keying is done on the buffer and first and second multiplier stages.

1.2. REFERENCE DATA.

Power Source: 115 volts ac 50/60 cps single phase.

Power Input Requirements: The maximum overall input power requirement is 500 watts at 90% power factor.

PA Plate Power Input: The nominal rated power input of the 32V-3 is 120 watts on phone and 150 watts CW.

Audio Distortion: Audio distortion is less than 10% at 90% modulation with a 1000 cps input frequency.

Frequency Response: Within 2 db from 200-3000 cps.

1.3. TUBE COMPLEMENT.

Quantity	Tube Type	Function
1	6SJ7	Oscillator
1	6AK6	Buffer Amplifier
1	6AG7	First Multiplier
1	7C5	Second Multiplier
1	7C5	Third Multiplier
1	4D32	RF Power Amplifier
1	| 6SL7	Audio Amplifier
①	𝍸 6SN7	Audio Driver
2	807	Modulators
1	5Z4	LV Rectifier
②	|| 5R4GY	HV Rectifier
1	VR-75	Bias Regulator
2	OA2	Screen Voltage Limiters

SECTION II

INSTALLATION

2.1. UNPACKING.

After removing the unit from the packing box, inspect the unit for loose screws or bolts. Be certain all controls, such as switches, dials, etc. work properly. In case of damage, file all claims promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved. To assure the clearing away of all packing or blocking materials, remove the transmitter from its cabinet. When removing the transmitter, support the rear of the chassis to prevent breaking the interlock switch on the right rear edge. Check all tubes to see that they are fully in their sockets. See figure 2-1 for tube placement.

2.2. PLACING TRANSMITTER.

The console type cabinet is designed to be placed on the operating table along with the receiving equipment. Allow enough space at the rear for making the necessary external connections and for replacement of fuses. Provide sufficient clearance at the sides for full circulation of air.

2.3. EXTERNAL CONNECTIONS.

Place the two power switches in the off position before attempting to make any external connections. These connections are as follows:

(1) AC Power Line
(2) Microphone and Key
(3) Radiation System
(4) Remote Relay
(5) Receiver Disabling Circuit
(6) Remote Push-To-Talk

2.3.1. POWER LINE. The 32V-3 operates from a 115 volt, single phase, 50/60 cycle power source. The maximum power required from the line is 500 watts. Check the power line to see that it meets these specifications. Insert the 115 volt plug into a convenient standard outlet.

2.3.2. MICROPHONE AND KEY. The microphone plug is inserted in the microphone jack, J201, on the front of the transmitter. Make sure the clamping ring on the microphone plug is tightly turned on the thread around the input receptacle. Push-to-

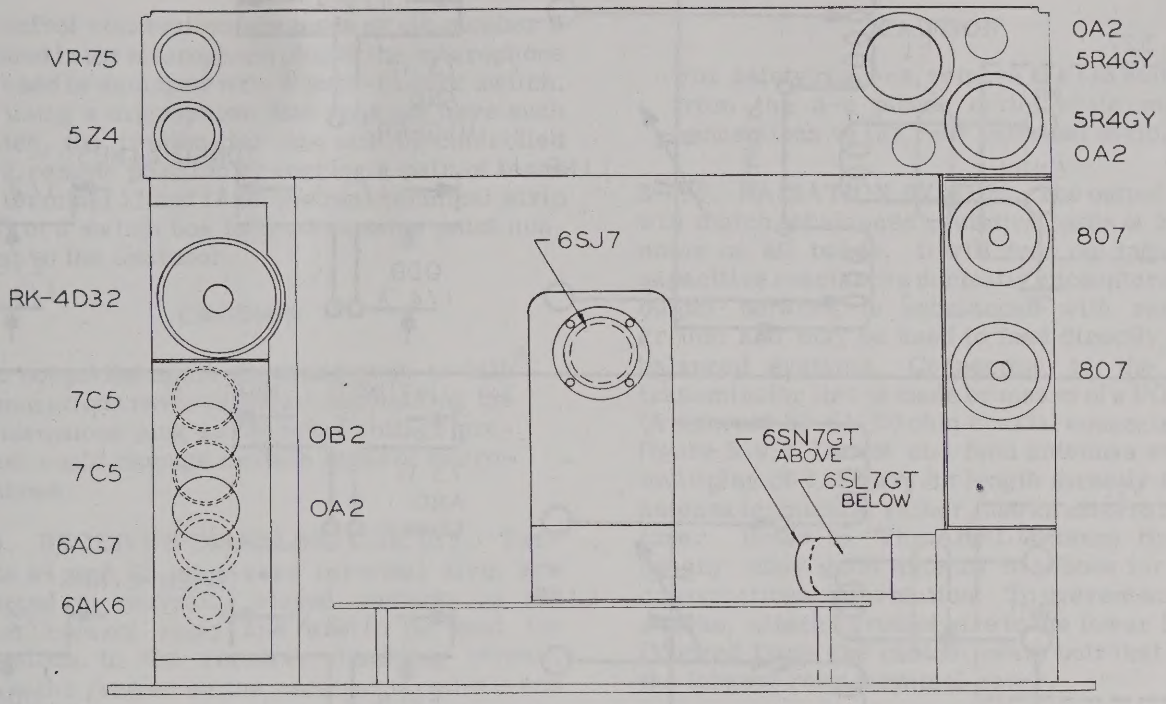
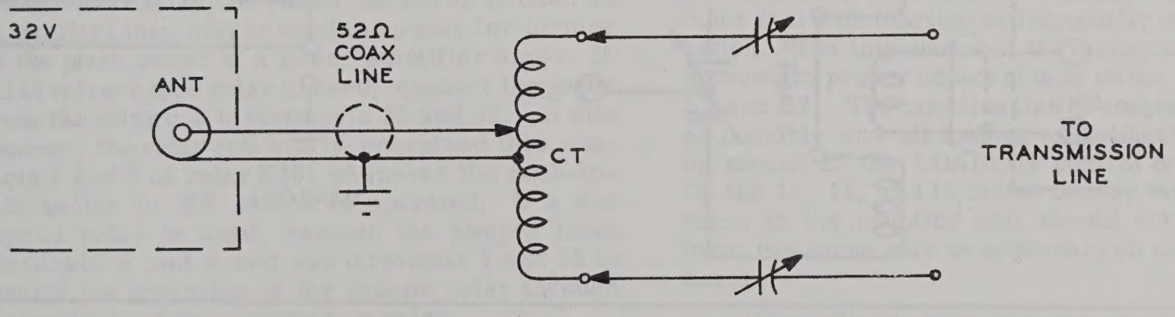
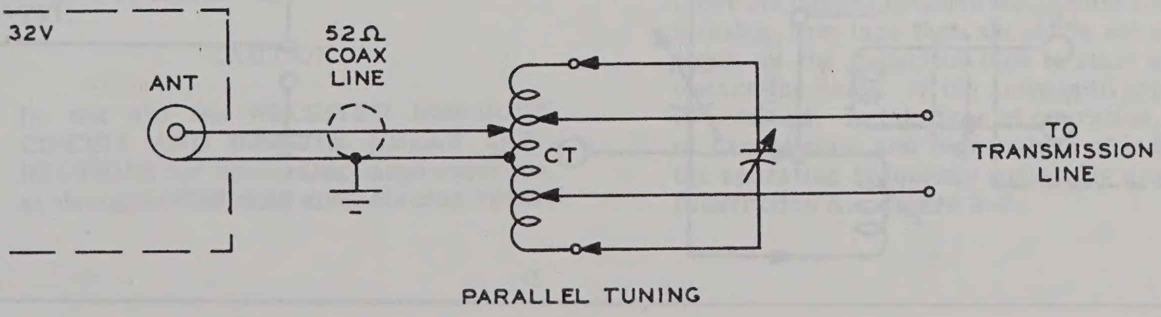


Figure 2-1 Tube Placement Diagram



SERIES TUNING



PARALLEL TUNING

Figure 2-2 Typical Antenna Tuner

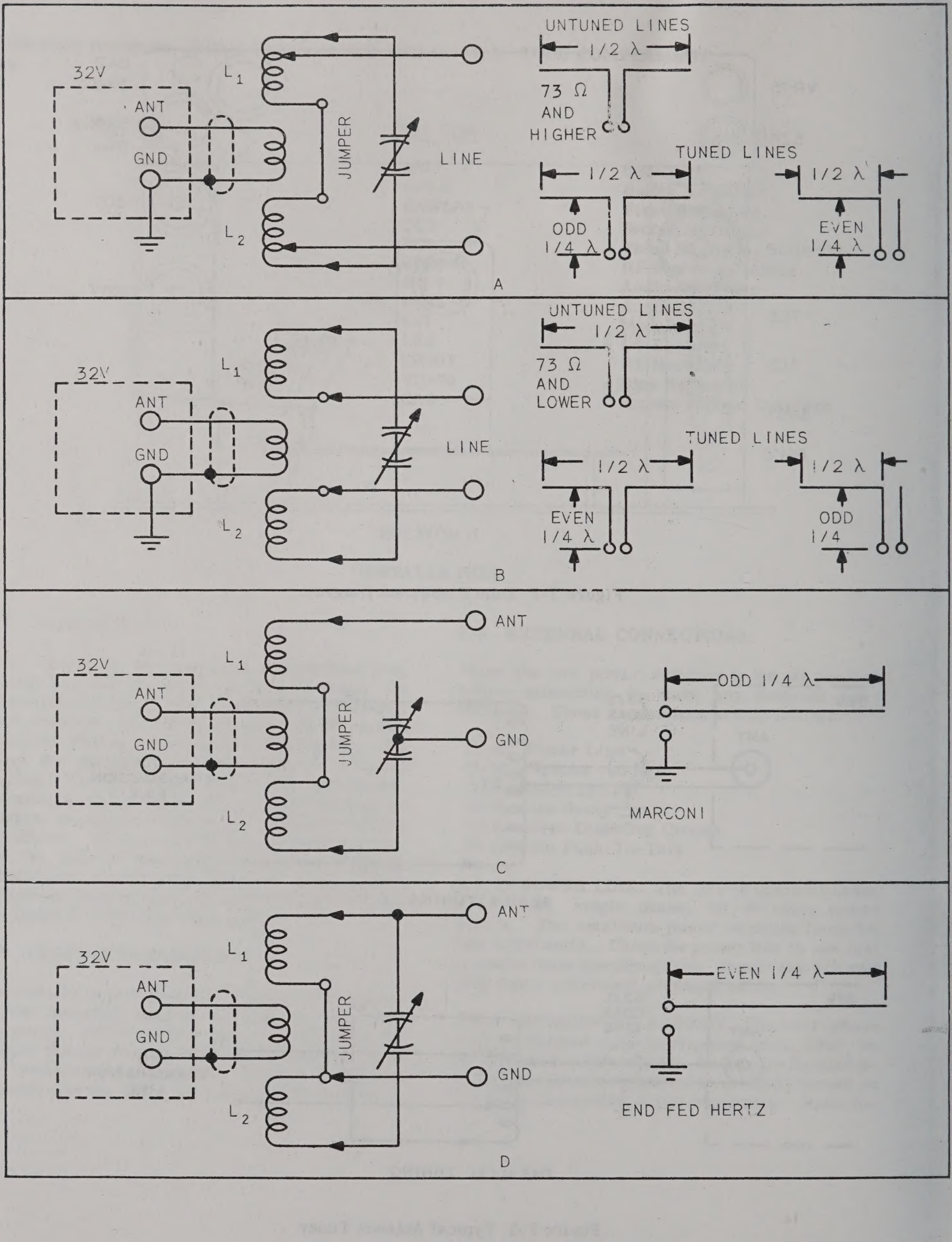


Figure 2-3 Typical Antenna Tuner Circuits

talk control connections are made to pin number 2 to ground in the microphone plug if the microphone being used is equipped with a push-to-talk switch. When using a microphone that does not have such a switch, the transmitter can still be controlled from a remote position by running a pair of leads from terminal 11 and 12 on the rear terminal strip (E308) to a switch box located at some point convenient to the operator.

CAUTION

Do not get the microphone and push-to-talk connections reversed when assembling the microphone plug as the relay voltage present could damage certain types of microphones.

2.3.3. RECEIVER DISABLING CIRCUIT. Terminals 24 and 25 on a rear terminal strip are connected to normally closed contacts on the carrier control relay and are to be used for connections to the receiver disabling circuit. Remove the jumper on the receiver terminals and connect to these two terminals. The receiver can then be made inoperative when the push-to-talk switch is pressed or whenever the HV switch is operated.

2.3.4. REMOTE RELAY CONNECTIONS. Terminals 8, 9, 22 and 23 at the rear of the terminal strip may be used for operating an antenna change-over relay, or (when the 32V-3 is used as an exciter) they may be used as a relay for turning on the plate power of a power amplifier stage. If a 115 volt a-c type relay is used, connect the leads from the relay coil to terminals 22 and 23. In this manner, the relay coil will be energized thru contacts 8 and 9 of relay K301 whenever the push-to-talk switch or HV switch is operated. If a d-c type of relay is used, remove the jumper from terminals 8 and 9 and use terminals 9 and 23 to control the operation of the remote relay through the contacts of the transmitter relay.

CAUTION

Terminals on E-308 are not filtered for TVI.

CAUTION

Do not use the RECEIVER DISABLING CIRCUIT AND REMOTE RELAY CONNECTIONS for conducting large currents, as damage to the relay contacts may result.

CAUTION

For safety reasons, remove the 115 volt plug from the a-c power outlet while making connections to the rear terminal strip.

2.3.5. RADIATION SYSTEM. The output network will match unbalanced resistive loads of 26 to 200 ohms on all bands. It will tune out inductive or capacitive reactances normally encountered. The output network is unbalanced with respect to ground and may be used to feed directly into unbalanced systems. Connection to the antenna transmission line is made by means of a UG-21B/U (Amphenol 82-61) 50 ohm coaxial connector. (See figure 5-9.) Do not end feed antennas which are multiples of 1/2 wave in length directly from the antenna terminals; rather, use an external antenna tuner. Refer to "The ARRL Antenna Handbook" or any other good antenna handbook for antenna constructional information. To prevent accidental shocks, attach a ground wire to the lower left hand (Viewed from the cabinet rear) bolt that secures the largest rear terminal cover.

2.3.6. EXTERNAL ANTENNA TUNER. (Not available) To feed balanced transmission lines, tuned or untuned, couple the transmitter to the transmission line through a simple, tuned circuit. This arrangement will match a wide range of impedances. It will also add further attenuation to harmonics causing TVI, providing it is completely shielded. Figure 2-3 illustrates an antenna tuner that will function satisfactorily in this application. The impedance of the transmission line is matched by proper choice of taps on the inductances L1 and L2. The coupling link is coupled as tightly as possible and all loading adjustments are made by means of the LOADING control on the 32V-3. On the 15, 11, and 10 meter bands, the number of turns in the coupling coil should not exceed one turn; two turns may be necessary on the 20 meter band.

a. UNTUNED HIGH IMPEDANCE TRANSMISSION LINES. If the line has a characteristic impedance of 73 ohms or more, employ parallel tuning of the antenna coils L1 and L2. For parallel tuning, close the jumper between the antenna coils. Transmission line taps then should be set on the same turns as the capacitor taps to start with, varied toward the center of the coils until proper loading is obtained. In this type of operation, low values of capacitance and high values of inductance for the operating frequency generally are best. See illustration A., figure 2-3.

b. UNTUNED LOW IMPEDANCE TRANSMISSION LINES. Transmission lines having a characteristic impedance of less than 50 ohms require series tuning of the antenna coils. This is done by opening the jumper between the coils and moving the transmission line tap arms to the inside coil turns. The capacitor taps should be set at the outside turns and varied toward the inside turns until proper loading is obtained. Higher values of tuning capacity usually work out best in this type of operation. See illustration B., figure 2-3.

c. VOLTAGE FED TUNED LINES. Transmission lines that have high voltage points at the tuner should be connected and tuned according to specified instructions in paragraph a. above. These lines should be cut to exact multiples of a quarter wave in length.

d. CURRENT FED TUNED LINES. Transmission lines having high current at the tuner end should be connected and tuned according to instructions given in paragraph b. above. These lines should also be cut to exact multiples of a quarter wave in length.

e. QUARTER WAVE MARCONI. Series tuning is indicated for quarter-wave Marconi antennas. In this type of operation, connect the antenna tuning circuit so that the two sections of the antenna coil and one-half of the antenna tuning capacitor are in series. To do this, place a grounding jumper to the rotor of the antenna tuning capacitor, connect the antenna to one end of the antenna coil, connect one stator of the tuning capacitor to the other end of the antenna coil and disconnect the other stator completely. See illustration C., figure 2-3. In event r-f voltage appears on the cabinet, it can be minimized by extending the ground wire to 1/2 wave length and series tuning it until resonance is obtained.

f. END FED HALF WAVE. This tuner can be used to tune this type of antenna also. Employ parallel tuning for this type of operation. Connect the antenna to one end of the antenna coil, make a ground connection to the inside turn of one of the antenna coils and close the jumper between the coils. The tuning capacitor taps should be equally spaced from each end of the antenna coils for proper tuning at the operating frequency. See illustration D., figure 2.3

2.3.7. ANTENNA TUNER ADJUSTMENT. After recognizing the high order of filtering that it was necessary to incorporate in an amateur transmitter operating in close proximity to television receivers, Collins engineers designed an output network to be used in the 32V-3 which should offer a great deal of attenuation to high order harmonics. In order to do this, it was necessary that an additional "L" section filter be added to the existing pi section. This new section contributes a great deal of filter action, but also offers some disadvantages. The first apparent difficulty noted is the apparent sharpness of tuning on the high frequency bands, particularly 28 mc. It must be recognized that this is inherent in any tuned filter where a high degree of selectivity is needed and the fact that it does tune so sharply indicates that it is operating properly.

The pi section network was designed so that when used with the L section, a suitable range of impedances could be satisfactorily matched. The extreme cases were tabulated and the resulting voltages and currents were calculated. These voltages and currents were of such a magnitude as to not exceed the ratings of the components. However, when the customer connects the 32V-3 to an antenna system, frequently the standing waves are of such a nature as to reflect sufficient reactance so that the assigned endpoints of impedances are exceeded. This may result in an excess current thru the loading capacitors and subsequent failure.

However, when adequate precautions are taken, this problem can be greatly reduced. These precautions may be described simply by stating that they are directed in such a manner as to insure a flat 52 or 72 ohm line from the 32V-3 to the antenna tuner. The tuning procedure is as follows.

Disconnect the coaxial line from the antenna tuner link and terminate it in a non-inductive resistor whose value is the same as the Z_0 of the coaxial line, and whose power rating is sufficient to dissipate 50 watts or so for prolonged periods. The transmitter should then be tuned and loaded to the proper point in the "tune" position. The unit should then be momentarily switched to the operate position to see that the final plate current reading is correct. In the event that non-inductive resistors are not available, it is possible to use a 100 watt lamp and obtain a SWR of about 1.5/1 on a 52 ohm line.

The coaxial line should then be connected through a series variable capacitor to the antenna tuner link of one turn on 10, 15 and 20 meters, two turns on 40 meters and three on 80 meters. The antenna tuner is resonated with the transmitter and the link reactance tuned out with the coaxial line series capacitor. The feeders should then be moved in equal increments out from the center, with the tuned circuit resonated, until the same loading condition exists that was noted with the dummy load. This will set up the desired condition where the transformation of impedance from the coaxial line is from 52 or 72 ohms to the antenna impedance. If this is done no standing waves will exist on the coaxial line and the loading capacitors will not be operated at excessively high values of current.

2.3.8. 35C-2 FILTER INSTALLATION. If a 35C-2 Low Pass filter is used, install as indicated in the 35C-2 book. Make the interconnecting coax lead as short as possible.

2.3.9. TELEVISION INTERFERENCE. The design of the 32V-3 transmitter is such that spurious radiation has been reduced to a low value, particularly on television frequencies.

The rf unit is completely shielded in a metal box inside the main cabinet. Most circuits passing through the cabinet are filtered for attenuation at television frequencies. These features minimize direct radiation from the cabinet and external leads.

Spurious radiation from the antenna is attenuated by careful design of the rf circuits. In the power amplifier the use of a pi section followed by a L section is effective in reducing harmonics of the carrier frequency. Use of a coaxial transmission line from the transmitter to the transmitting antenna is recommended.

However, when a television receiver is operated within a few hundred feet of a powerful transmitter, even though the transmitter does not radiate an interfering signal on the TV channel, it is to be expected that interference may be caused by lack of enough selectivity in the television receiver input circuit.

In such cases, improve the receiver selectivity by installing a high pass filter at the receiver antenna terminals. If a booster is used at the television receiver, install the high pass filter at the antenna input terminals of the booster and use very short leads between the booster outputand the television receiver input.

If the interference persists and proves to by high frequency harmonic output of the transmitter, install a low pass filter as closely to the transmitter antenna connector as possible. The transmitter cabinet is punched to mount a Collins type 35C-2 low pass filter which has at least 70 db attenuation to all outputs 54 megacycles or higher.

The following publications contain information on the elimination of television interference at the receiver: The Radio Amateur's Handbook published by The American Radio Relay League, West Hartford, Connecticut; and Television interference, published by Remington Rand Laboratory of Advanced Research, South Norwalk, Connecticut.

SECTION III

ADJUSTMENT AND OPERATION

3.1. ADJUSTMENT.

3.1.1. 600 v - 700 v SWITCH. This switch, located in the primary of the power transformer, has been placed at the rear of the transmitter to select output voltages of either 600 or 700 volts. It is recommended that this switch be placed in the 600 volt position for initial adjustments.

3.1.2. CALIBRATION. To check dial calibration, proceed as follows:

a. Turn the equipment ON as outlined in steps a. and b. paragraph 3.2.3.

b. Tune a communications receiver to WWV at 10 mc. The BFO in the receiver should be OFF.

c. Rotate the BAND switch to 80 meter band. (lowest scale)

d. Rotate the TUNING dial to 4.0 mc.

e. Rotate the CW-CAL-PH control to CAL. This turns the VFO, buffer, first and second multiplier stages ON so that a calibration signal can be heard. Close the telegraph key.

f. Continue to rotate the TUNING dial about 4.0 mc until the calibration signal is zero beat with WWV.

g. Turn the FIDUCIAL screw until the hair line is on 4.0 mc.

h. In like manner the dial can be calibrated on 15,000 kc by setting the communications receiver at WWV on 15 mc and the 32V-3 TUNING dial at 15 mc on the 20M BAND position. See the following table.

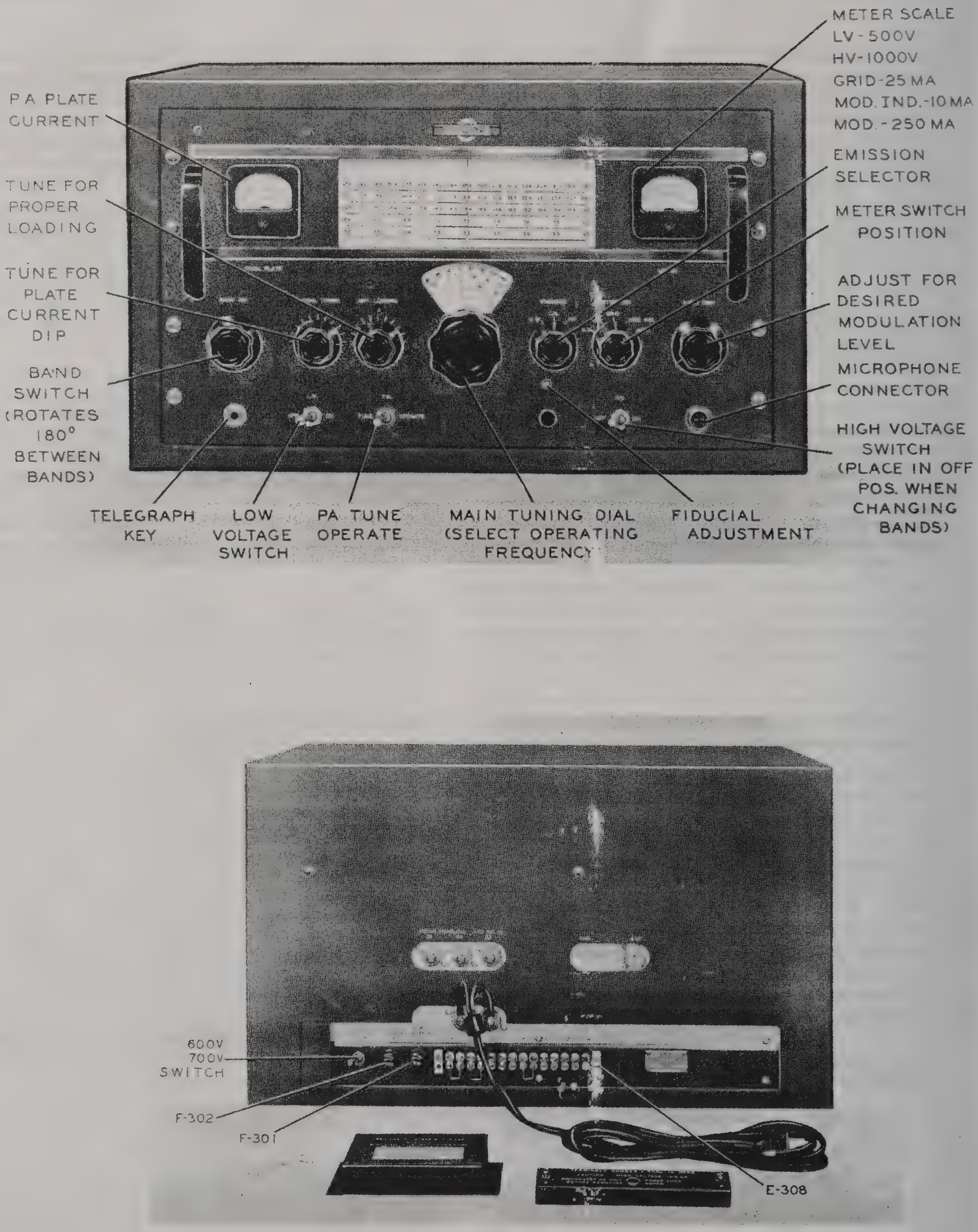
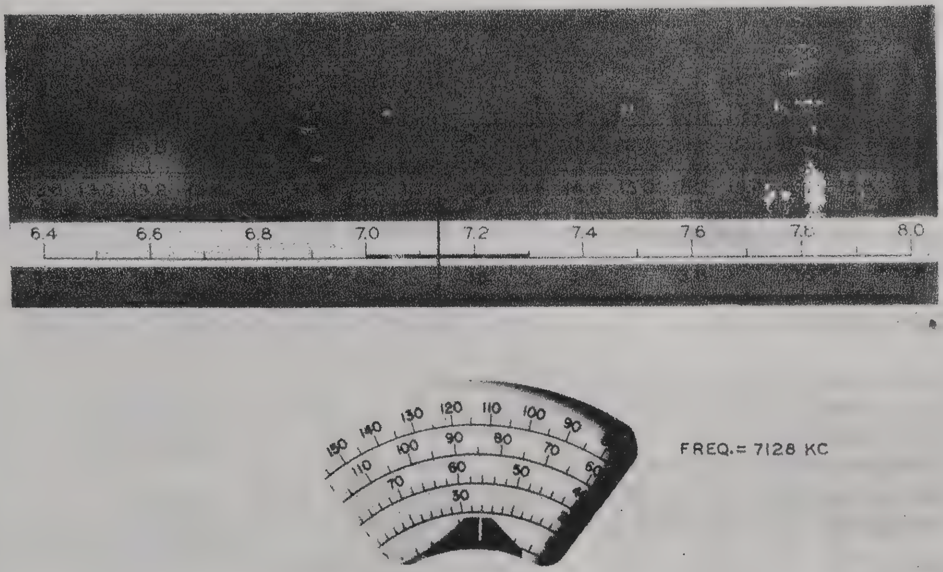
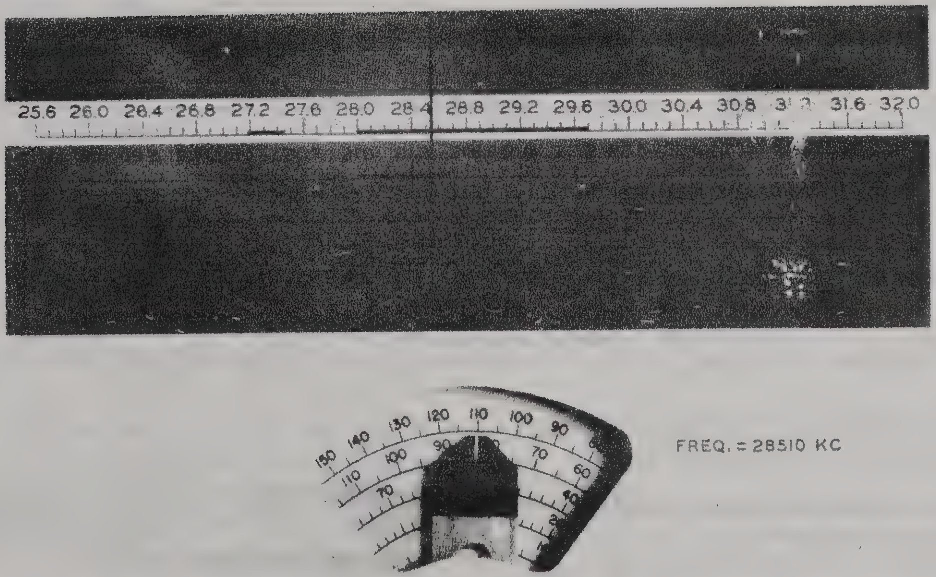


Figure 3-1 32V-3 Control Functions



FREQ.= 7128 KC



FREQ. = 28510 KC

Figure 3-2 Typical Dial Readings

WWV Frequency	Dial Setting	Oscillator Frequency	Oscillator Harmonic
10 mc	4,000	2,000	5th
15 mc	15,000	1,875	8th
15 mc	7,500	1,875	8th

3.2. OPERATION.

3.2.1. GENERAL. Operation of this equipment is exceedingly simple once the functions of the controls are understood. The function of the controls is hereby given, followed by a step-by-step procedure for operation of the equipment.

3.2.2. FUNCTION OF CONTROLS.

a. BAND SWITCH. This control selects the proper tuning elements for all stages of the amateur band upon which operation is desired. The knob rotates 180 degrees between adjacent bands. Clockwise rotation selects higher frequency bands. The band selected is indicated by the band lighted slide rule dial.

b. TUNING CONTROL. This control operates both the slide rule dial and the vernier dial to select the exact frequency upon which operation is desired.

c. CW-CAL-PH SWITCH. This three-position switch selects the type of emission required. In the CW position, the secondary of the modulation transformer is short circuited, the screen voltage is removed from the modulator tubes, a bleeder is placed between the PA screen grid to ground and the carrier-control relay is connected so that it can be operated by the HV switch. The transmitter is ready for CW operation when the key is inserted in the KEY jack. In the CAL position, the VFO, buffer, and three multiplier stages are in operation to supply a signal of suitable strength for zero-beating against received signals without causing interference to other stations. The carrier control relay is disconnected from the HV switch so that the associated receiver and antenna changeover relay will be in the "Receive" condition. In the PH position, the switch opens the short circuit on the secondary of the modulation transformer, closes the keying circuit, applies screen voltage to the modulator tubes and connects the carrier control relay so that it can be operated by the HV switch or a push-to-talk switch on a microphone.

d. METER SWITCH. The METER switch selects various circuits to be metered by the meter directly above the switch. This meter has 3 scales: 0-250; 0-500 and 0-1000. The table below indicates how it is used.

Meter Switch Position	Circuit Metered	Full Scale Deflection Reads
LV	Low voltage	500 volts
HV	High voltage	1000 volts
GRID	PA grid current (DC)	25 ma
MOD IND	Mod. grid current	10 ma
MOD	Mod. plate current	250 ma

The meter on the left reads PA Plate current only. Full scale deflection reads 300 ma.

e. AUDIO GAIN. This control adjusts the level of modulation in phone operation.

f. LV SWITCH. The LV switch turns on the filaments and the low voltage plate and bias supply. (Plate voltage is not applied to the r-f exciter tubes, however, until the HV switch is turned on, except when the CW-CAL-PH switch is on CAL position.)

g. HV SWITCH. The HV switch turns on the high voltage supply and connects plate voltage to the r-f exciter tube through operation of carrier control relay K301. The push-to-talk connections are in parallel with this switch.

h. FINAL TUNING. This control is used to obtain resonance of the PA plate circuit. It must be reset after each adjustment of the ANT. LOADING controls.

i. ANT. LOADING. This control is used to obtain correct antenna tuning and loading. Start with this control in position number 1. Usually the 80-meter band will load up on position 1, 2, or 3, the 40-meter band on 4, the 20-meter band on 5, the 15-meter band on 6, and the 10 and 11-meter bands on position 6 of the loading control.

j. TUNE-OPERATE SWITCH. This switch inserts some resistance in the primary of the power transformer in the TUNE position to reduce plate voltage during the tuning procedure. This switch should always be used to protect the power amplifier tube in off resonance conditions.

k. FIDUCIAL. This control, a small screwdriver adjustment located directly under the CW-CAL-PH knob, is used to move the vernier dial index during calibration adjustments. Once it has been set, further adjustment will be unnecessary over long periods of time.

l. 600 - 700 v SWITCH. This switch, located at the rear of the chassis, is used to select either 600 or 700 volts (approx.) for application to the plate.

3.2.3. OPERATION PROCEDURE.

a. Operate the LV switch to the ON position. Allow two minutes for the tubes to heat.

b. Turn the AUDIO GAIN to the counterclockwise stop. (off)

c. Turn the ANT. LOADING control to position 1. (minimum loading)

d. Place the CW-CAL-PH control in the position indicating the desired emission.

e. Rotate the BAND switch to the band containing the desired operation frequency.

f. Rotate the TUNING dial to the desired frequency.

g. Place the Meter selector switch in the GRID position and close the telegraph key. (If PH emission was selected, it will not be necessary to close the key.)

h. Place the TUNE-OPERATE switch in the TUNE position.

i. Observing the FINAL PLATE meter, turn the HV switch ON and quickly turn the FINAL TUNING to resonance, i.e. minimum plate current dip.

j. Observe the GRID current reading on the right hand meter. This should be between 5 and 15 ma.

k. Operate the ANT. LOADING control clockwise until approximately 125 ma loading is obtained while keeping FINAL TUNING at resonance. Repeat this procedure until 125 ma reading is obtained with complete resonance of PA. If it is impossible to load to 125 ma PA plate current, rotate the ANT. LOADING control clockwise until proper loading is obtainable.

l. Place the TUNE-OPERATE switch in the OPERATE position and load the PA to 180 ma with the ANT. LOADING control maintaining resonance with the FINAL TUNING control.

WARNING

> Operation of this equipment involves the use of high voltages which are dangerous to life. Observe all safety regulations. Do not change tubes or make adjustments inside equipment with the high voltage supply ON. Do not depend upon interlocks for protection but always turn the high voltage supply OFF. SWITCH TO SAFETY.

m. If CW emission is selected, the telegraph key can be opened and the transmitter keyed. If PH (phone) emission is selected, turn the METER switch to MOD. and observe the static (resting) modulator plate current. This should be about 50 ma for the 600 v position of the 600 - 700 v switch at rear (55 ma on the 700 v position). While speaking in normal tones into the microphone, advance the AUDIO GAIN control until the modulator plate current swings to about 100 ma on peaks. This will result in approximately 100% modulation with voice input. If desired, a more exact check of modulation level can be made with an oscilloscope while observing the proper meter swing for the voice of the individual operator.

With sine wave input, the modulator plate current will read about 200 ma for 100% modulation.

With the METER switch set to MOD. IND. a slight kick of the needle indicates approximately 100% modulation on voice peaks. This is useful as an alternate method of indicating modulation level since no deflection occurs on the meter until the modulation level reaches approximately 55%. The level at which the meter kicks depends somewhat upon the loading of the final amplifier and characteristics of the modulator tubes.

NOTE

In step g. above, the key plug can be pulled from the key jack since this is a closed circuit type jack.

CAUTION

When changing BANDS, place the HV switch in the OFF position. Also place the PUSH-TO-TALK switch in the OFF position.

NOTE

If the 600 - 700 v switch is placed in the 700 v position, the PA plate current should be 200 ma.

3.2.4. TYPICAL METER READINGS. (PH position without modulation.)

POSITION OF S305	LV	HV	GRID	MOD	FINAL PLATE BOTH PHONE & CW
600 v	240	580	7-10	50	160
700 v	240	720	7-10	55	200

3.2.5. DIAL CALIBRATION. When changing BANDS, the proper scale on the slide rule dial is illuminated automatically as the BAND switch is rotated. At the same time, the vernier dial fiducial moves up or down the vernier dial face and stops at the corresponding scale to which the slide rule dial is positioned.

The dial is read by combining the vernier dial reading with the slide rule dial reading. The exact method varies somewhat for the low frequency bands and the high frequency bands and can best be learned by referring to figure 3-2.

3.2.6. ANTENNA LOADING TABLE. This table indicates the approximate position for the antenna loading control when loading into various antenna impedances on the different bands.

POSITION OF ANT. LOADING CONTROL
(for resistive loads)

FREQ MC	26 ohm LOAD	50 ohm LOAD	100 ohm LOAD	300 ohm LOAD
3.5	2	2	2	2
4.0	3	3	3	4
7.0	4	4	4	4
7.3	4	4	4	4
14.0	5	5	5	5
14.4	5	5	5	5
21.0	6	6	6	6
21.45	6	6	6	6
27.2	6	6	6	6
28.0	6	6	6	6
29.7	6	6	6	6

SECTION IV

CIRCUIT DESCRIPTION

4.1. GENERAL.

4.1.1. The following paragraphs have been written to enable the owner of a 32V-3 to understand the functioning of his transmitter more full. This section should be read and understood before any extensive servicing is attempted.

4.2. CIRCUIT DESCRIPTION.

4.2.1. RF CIRCUITS.

a. OSCILLATOR. A type 6SJ7 tube is employed in a highly stabilized master oscillator circuit to generate the controlling radio frequency voltage. This frequency generating unit is a linearly - tuning permeability tuned oscillator with a range of 1.6 to 2 megacycles. Sixteen turns of the main tuning dial cover this range. This provides 50 KC per revolution of the second harmonic (3.2 to 4 mc band). With the end points properly set up, the tuning curve is linear within one dial division of the ideal tuning curve on any of the bands in the operating range. The oscillator circuit is compensated for temperature changes and is entirely enclosed in a heavy aluminum case. The filament of the oscillator is separately excited by T-303 and is biased by negative 42-V taken from R-305 and R-306 to eliminate possibility of hum modulation.

b. INTERMEDIATE STAGES. Following the master oscillator a type 6AK6 is employed in an untuned, Class A amplifier stage. This stage completely isolates the master oscillator from the remaining tuned stages. The 6AK6 drives a series of three frequency multiplier tubes, the first of which is a type 6AG7. The operating frequencies at the plate of the multiplier tubes for the different bands is given in the following table.

BANDS		1ST MULT. 6AG7	2ND MULT. 7C5	3RD MULT. 7C5
1	80M	3.5 mc	3.5 mc	3.5 mc
2	40M	3.5 mc	3.5 mc	7 mc
3	20M	3.5 mc	7 mc	14 mc
4	15M	5.75 mc	10.5 mc	21 mc
5	11M	6.8 mc	13.6 mc	27 mc
	10M	7 mc	14 mc	28 mc

Plate screen and filament power for these stages is obtained from the low voltage power supply. Gang tuning of the multiplier stages is obtained by moving powdered iron cores, attached to a common platform, in and out of the plate coils which are wound to give linear tuning. This platform to which the iron cores are attached is also ganged to the master oscillator tuning for complete, single control tuning of the exciter stages. Band switching is accomplished by adding extra padding capacity across coils by means of the band switch in all cases except that of the 14-mc output of the third multiplier where an inductance is switched in parallel with the existing 40 meter inductor to lower the tuning inductance for 14 mc output.

c. POWER AMPLIFIER STAGE. A type 4D32 tetrode power amplifier tube is used in the PA stage. This tube always operates as a straight amplifier. The plate circuit is tuned by a combination pi-network and "L" network which is band-switched along with the multiplier stages. The combination network reduces the output impedance to around 50 ohms on all bands by means of inductance and capacitance switching. The output network will actually operate satisfactorily with antenna impedances in the range of 26 to 200 ohms. It is also affective in reducing harmonic output of the transmitter. During phone transmission, the screen grid and plate of the 4D32 are both modulated. Plate and screen voltage is obtained from the high voltage supply while filament power is obtained from the low voltage plate supply transformer. The tube is biased with 75 volts of fixed-bias plus some grid leak bias.

4.2.2. AUDIO CIRCUITS. The first and second audio amplifier consists of a type 6SL7 tube operated as a cascade amplifier. A volume control, R205, is located in the grid circuit of the second amplifier stage. The driver stage employs a type 6SN7 tube with the two triode sections operated in parallel to drive the modulator stage. The modulator stage utilizes a pair of type 807 tubes connected in a push-pull circuit and operating class AB$_2$. The output of the modulator is coupled to the final amplifier by transformer, T202, to modulate the plate and screen of that stage. During CW operation, the secondary of the modulation transformer is shorted out by S302A. Bias for the modulator tubes is adjustable by R305, is obtained from the low voltage supply and is regulated by the voltage regulator tube, V304, type VR-75. The secondary of the modulation transformer has a 500-ohm tap provided for supplying 60 watts of audio power to an external load.

4.2.3. HIGH VOLTAGE SUPPLY. The high voltage transformer is energized when the contacts of relay K301 are closed. The high voltage supply employs two type 5R4GY rectifier tubes connected in parallel in a full wave circuit. The output is filtered by a single section choke input filter. This supply furnishes voltage for the plate and screen of the final amplifier and plate voltage for the modulator tubes. The amount of output voltage from this supply may be either 600 volts or 700 volts, depending on the position of the tap switch, S305, in the primary winding of the high voltage transformer, T302. For the same power input, the efficiency of the final amplifier improves with the higher operating voltage. The tube manufacturer recommends no more than 600 plate volts for phone operation, but this is for CCS rating. A pair of 15-ohm resistors are connected in series with HV plate transformer primary for "tune-up". These are shorted out when operating.

4.2.4. LOW VOLTAGE SUPPLY. Transformer T301 furnishes power for both the low voltage plate supply and the filament of all tubes in the transmitter except the Oscillator. T301 is energized by closing the LV switch, S304. Three separate windings on transformer, T301, furnishes filament power to the tubes. The low voltage plate supply employs a type 5Z4 rectifier tube in a full wave circuit with a two section choke input filter. This supply has a total output voltage of approximately 315 volts, 240 volts is supplied to the audio amplifier, oscillator, buffer and multiplier stages. Bias voltage for the modulator and final amplifier stage is furnished by this supply. It also supplies voltage for the operation of relay, K301.

SECTION V

MAINTENANCE

5.1. INSPECTION.

5.1.1. GENERAL. This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5.1.2. ROUTINE INSPECTION. Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects and deterioration of components.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is suggested that this inspection be made as frequently as possible, and it should be sufficiently thorough to include all major electrical circuits of the equipment as well as of the mechanical portion.

a. CLEANING. The greatest enemies of uninterrupted service in equipment of this type are corrosion and dirt. Corrosion, itself, is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity accumulates in any part of the equipment. It is very important that rotating equipment, such as variable condensers and tap switches, be kept free from dust to prevent undue wear. Likewise, variable condenser plates should be kept free from dirt to avoid flashover.

One of the greatest sources of trouble in equipment located in a salty atmosphere is corrosion. Corrosion resulting from salt spray or salt-laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as tap switches, tube prongs, cable plug connectors, and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

b. VACUUM TUBES. Make a check of emission characteristics of all tubes. After making the emission check, examine the prongs on all tubes to make sure they are free from corrosion. See that all tubes are replaced correctly and fully in their sockets, and that a good electrical contact exists between the tube prong and the socket. Use caution in removing and replacing grid or plate caps on tubes so equipped. Before a tube is discarded, make certain that the tube is at fault and the trouble is not due to a loose or broken connection within the equipment. A complete set of tested tubes of the same type specified should be kept on hand at all times. If faulty operation of the transmitter is observed and tube failure suspected, each tube may be checked by replacing it with a tube known to be in good condition. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit.

If tubes have been in use for a period of time equal to or exceeding the manufacturer's tube life rating, it is suggested that they be replaced. A marked improvement in the performance of the equipment is usually noticeable after the weak tubes have been replaced.

c. PRECAUTIONS FOR SATISFACTORY TUBE LIFE.

(1) Before removing any tube from the equipment, make certain the primary power is disconnected from the equipment.

(2) Operate all tubes within ±5% of rated filament voltage.

(3) Do not exceed the rated plate current of any tube during normal operation of the equipment.

d. TUBE REPLACEMENT PRECAUTIONS.

(1) All tubes are removed by pulling them straight away from the chassis. Some tubes have hold-downs, be sure these are loosened before pulling on these tubes.

(2) Remove plate cap connectors from tubes with great care to prevent breaking the seal around the plate cap.

(3) Before inserting a tube make certain it is of the correct type for the socket into which it is to be placed.

NOTE

> Changing master oscillator tubes (V001) may cause a slight change in master oscillator calibration.

e. TUBE TABLE.

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V001	6SJ7	Master oscillator	6.3
V101	6AK6	Buffer amplifier	6.3
V102	6AG7	Frequency multiplier	6.3
V103	7C5	Frequency multiplier	6.3
V104	7C5	Frequency multiplier	6.3
V105	4D32	Power amplifier	6.3

e. TUBE TABLE. (Cont.)

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V201	6SL7	Audio Amplifier	6.3
V202	6SN7	Audio driver	6.3
V203	807	Modulator	6.3
V204	807	Modulator	6.3
V301	5Z4	LV Rectifier	5.0
V302	5R4GY	HV Rectifier	5.0
V303	5R4GY	HV Rectifier	5.0
V304	VR75	Bias Regulator	---
V305	OA2	Screen Voltage Limiter	---
V306	OA2	Screen Voltage Limiter	---

f. RELAYS. - All relays should be inspected at regular intervals. Check the contacts for proper alignment, pitting and corrosion. Use a burnishing tool to clean contacts - never use sandpaper or emery cloth.

5.2. TROUBLE SHOOTING.

5.2.1. GENERAL. - The most common cause of improper operation of radio equipment is tube failure. Refer to paragraph 5.1.2., b. in this section for comments concerning vacuum tube replacement. Defective tubes causing an overload in power circuits may usually be located by inspection. High voltage arcs may be caused by bent condenser plates, corrosion or dust. Corrosion resulting from operating the equipment in a salt laden atmosphere may cause failure of the equipment for no apparent reason.

In general, trouble encountered in radio apparatus can be isolated by means of various tests and measurements; then the section of the transmitter in which the trouble is located can be determined. If this is done, the components in the associated circuit may be checked and the trouble located. Refer to the tables of meter readings and resistance measurements.

No one but an authorized and competent service man equipped with proper test facilities should be permitted to service this equipment.

5.2.2. FUSES.

a. GENERAL. This equipment is supplied with fuses of the correct rating in each position. Defective fuses should be replaced by spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Always replace a fuse with the rating specified by the following table.

FUSE TABLE

SYMBOL	LOCATION	TYPE	RATING
F301	LV Power supply primary	Cartridge (3AG)	3 amp.
F302	HV Power supply primary	Cartridge (3AG)	5 amp.

5.3. ALIGNMENT

5.3.1. GENERAL. If the exciter stages get out of alignment for any reason, it is recommended that the unit be realigned at once. Improper operation may result in damage to valuable equipment.

5.3.2. HIGH FREQUENCY OSCILLATOR. - Should trouble develop in the high frequency master oscillator, the unit should be returned to the factory for servicing. However, the unit can be serviced and realigned by persons understanding such techniques providing accurate test equipment is at hand. A crystal controlled frequency standard with outputs at 1700 and 2000 kc with an accuracy of better than .015 percent, must be used for setting the band edges.

a. PROCEDURE.

(1) Apply power to the transmitter and let the MO warm up for about 30 min. then check the oscillator frequency on a receiver. Operate the

transmitter with the emission control in the CAL position and the key closed.

(2) Couple a receiver to the output of the oscillator.

(3) Set the vernier index to exact center of the dial window.

(4) Tune receiver to output of 1700 kc freq. standard.

(5) Rotate MO to vicinity of 3400 kc on the exciter dial, and zero beat with the signal from the standard. Jot down dial reading for use as a reference.

(6) Rotate the MO dial toward 4 mc exactly 12 turns.

(7) Tune the receiver to the 2000 kc output of the standard.

(8) The MO should zero beat with the 2000 kc output of the standard at exactly 12 turns of the MO dial.

(9) If such is the case but the dial reading is incorrect, loosen the set screws in the oscillator coupler and turn the dial to the correct reading (4000 kc), after which tighten the set screws again. If the MO does not zero beat with the standard at 4 mc, proceed as follows.

(10) Read the kc difference (the difference between where the signal appeared and where it should have appeared after 12 turns) and multiply it by 5. Add this figure to the actual beat note dial setting if the beat note was less than 12 turns, or subtract it if the beat note occurred at more than 12 turns. Now set the dial to this new frequency, remove the trimmer plug from the top of the oscillator, and turn the adjustment until zero beat is again reached. It will be found that the high and low ends are very nearly 12 turns apart. Repeat the above procedure until such is the case; remember that a new reference point will occur at the low ends of the dial each time.

Examples of above operations:

#1

Beat note at low end of dial = 3402 kc
Reading at which beat note should appear after 12 turns of dial = 4002 kc
Actual dial reading = 4003 kc
Difference frequency (4003 - 4002) = 1 kc
Multiplied by 5 = 5 kc
Subtracted from 4003 (since beat note occurred at more than 12 turns) = 3998 kc

After setting dial to 3998 kc and zero bearing the MO to the standard with the trimmer adjustment, the low end beat note should appear at 3398 kc.

#2

Beat note on low end of dial = 3398 kc
Reading at which dial should appear after 12 turns = 3998 kc
Actual dial reading = 3996 kc
Difference frequency (3998 - 3996) = 2 kc
Multiplied by 5 = 10 kc
Added to 3996 (since beat note occurred at less than 12 turns of the dial) = 4006 kc

After setting the dial at 4006 and zero beating the MO to standard with the trimmer adjustment the low end beat note should appear at 3406 kc.

(11) After the oscillator has been adjusted to cover the range 3400 to 4000 kc in exactly 12 turns, the coupler set screws can be loosened and the dial set on frequency.

NOTE

The above method of adjustment is used at the factory. This is a short-cut method and proves very reliable. Actually, the object is to get the 1700 kc and the 2000 kc outputs of the oscillator exactly 12 turns apart. The objective can also be attained by using the slower method of moving the trimmer capacitor in one direction or the other, then checking results until the desired answer is obtained. Be sure to replace the trimmer cover plug after alignment.

NOTE

Somewhat greater accuracy can be obtained if the oscillator end points are set by using harmonic operation, i.e. listen in the 14 or 28 mc region for the hormonics of the 1700 and 2000 kc signals and set the corresponding harmonic of the MO to zero beat with these. Do this only after obtaining a very close adjustment as outlined above.

5.3.3. MULTIPLIER STAGES. - Should the grid drive to the final fall below 5 ma on the meter due to change of tubes or aging of components, the transmitter r-f circuits should be realigned. Proceed as outlined below only after the master oscillator has been checked and recalibrated as outlined in paragraph 5.3.2.

A small fiber screwdriver and a 1/4" open end wrench are required for these adjustments.

a. PROCEDURE.

(1) Remove the transmitter from the cabinet and tip it up on end. (RF section up.)

(2) Remove 3 access covers from perforated shield.

(3) Remove the fuse from the HV primary. (This allows the low voltage supply to be turned on while the HV supply remains turned off.)

(4) Turn the LV and HV power switches ON.

(5) Place the CW-CAL-PH switch in the PH position.

(6) Place the METER selector switch in the GRID position.

(7) Adjust for maximum grid current, using the adjustments and conditions listed below in order from top to bottom of the list. (Refer to figure 5-1 for adjustment identification.)

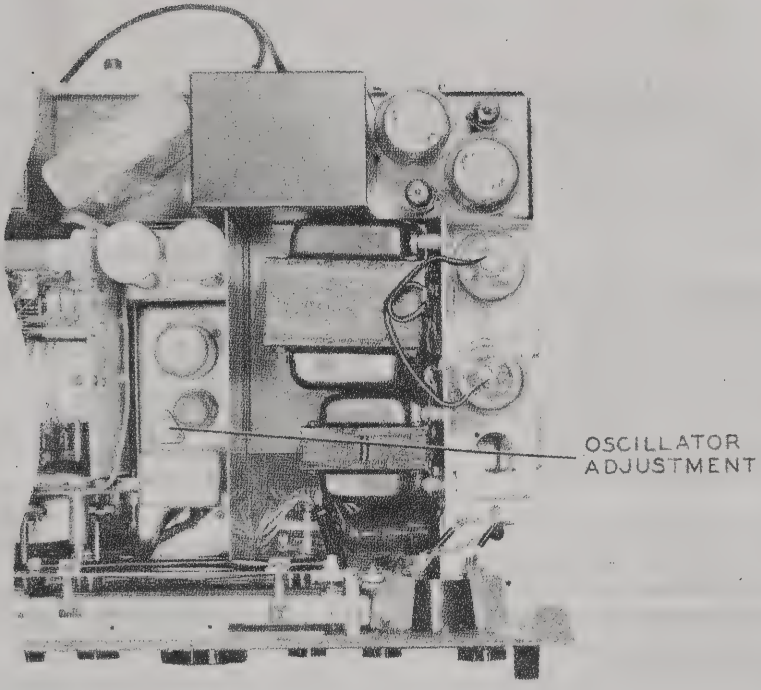
ORDER OF ADJUSTMENT	BAND SW SET AT	TUNING SET AT	ADJUSTMENT
1	10M	28,800	3 Slugs marked "28.8"
2	40M	7,300	C150
3	40M	7,200	1 Slug marked "7.2"
4	15M	21,600	3 Trimmers marked "21.6"
5	20M	14,250	3 Trimmers marked "14.4"
6	80M	3.750 kc	1 Trimmer marked "3.6"

NOTE

In item 5 under ORDER OF ADJUSTMENT, the mistracking of the third multiplier circuit will result in low grid current when the main tuning dial is set much outside the limits of the amateur 20-meter band (14 to 14.4 mc). Proper grid current can be obtained at any frequency on the range 12.8 to 16 mc by adjustment of trimmer C139 (marked 14.4 on the third multiplier.)

NOTE

If extensive multiplier alignment has been necessary, it is likely that the two spurious signal traps will need tuning. Do not touch the spurious signal tuning condensers unless that is so, since these adjustments are very critical. C149, the spurious signal trap tuning condenser for the 80-meter band, is located on the side of the multiplier unit next to C150, see figure 5-5. These traps are tuned as



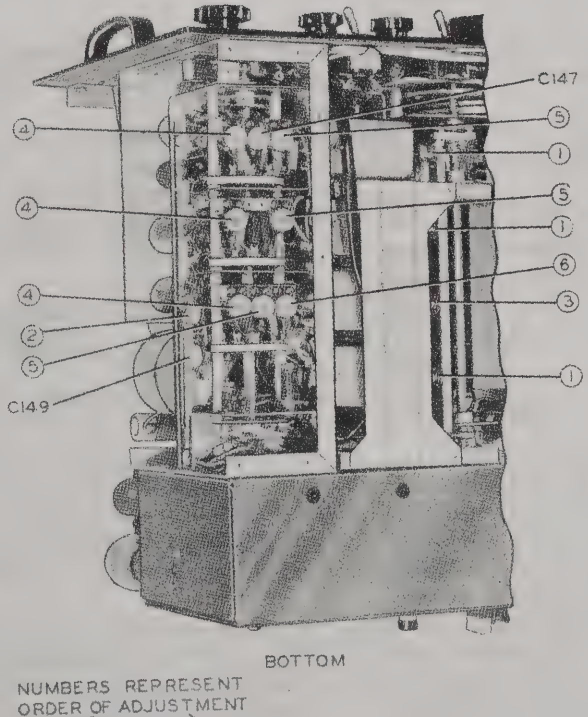


Figure 5-1 Alignment Adjustments

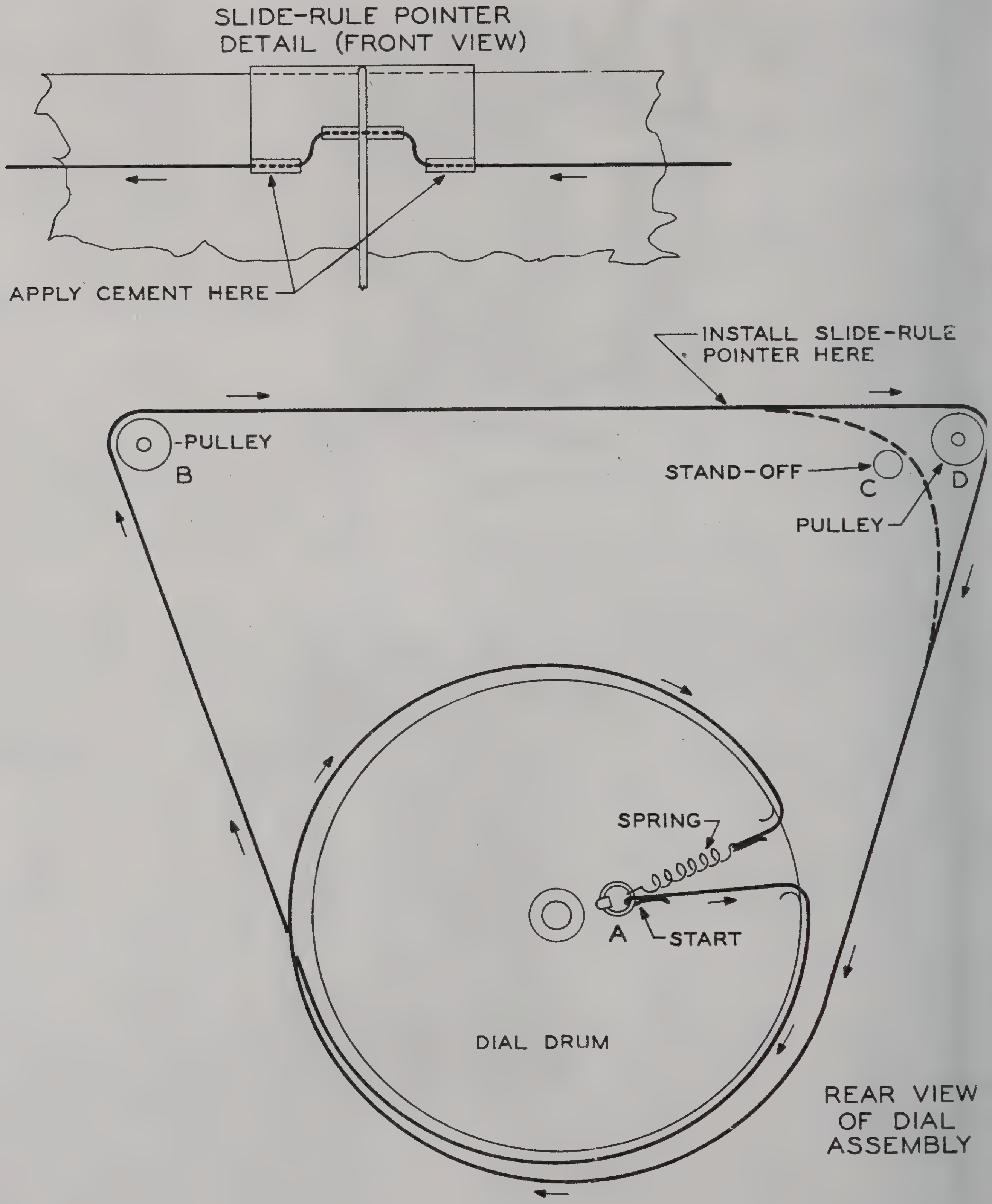

SLIDE-RULE POINTER DETAIL (FRONT VIEW)
APPLY CEMENT HERE
INSTALL SLIDE-RULE POINTER HERE
-PULLEY
B
STAND-OFF
C
D
PULLEY
SPRING
A
START
DIAL DRUM
REAR VIEW OF DIAL ASSEMBLY

Figure 5-2 Dial Restringing Drawing

NOTE (Cont.)

follows: With the transmitter aligned as indicated in the above paragraphs, tune the transmitter for 3.5 mc output and listen with a receiver to the 1.75 mc output. Watching the receiver "S" meter, tune C147 for minimum signal. Then tune the transmitter up on 7.15 mc and listen on 3.575 mc with the receiver. Adjust C149 for minimum signal. Both of these adjustments will be very sharp and care should be taken that they are not disturbed in the least after the adjustments have been made. Replace the multiplier bottom cover.

5.3.4. MODULATOR BIAS ADJUSTMENT. The modulator bias can be adjusted by turning the screwdriver slot equipped potentiometer R305. For best distortion characteristics, the static, or resting, modulator plate current should be 55 ma with the 600/700 v switch in the 700 v position. Potentiometer R305 is located within the top of the cabinet near the filter capacitors; therefore the interlock switch will have to be held closed while making this adjustment. Take great care to avoid touching any components carrying high voltage.

The proper bias for the modulator grids is approximately minus 25 volts.

5.4. LUBRICATION. The following parts should be lubricated annually or whenever the need arises by brushing a thin film of the indicated lubricant on the points of mechanical contact. Don't over-lubricate.

a. Panel Bushings: MOBILE PD535A (Socony Vacuum Oil Co.) or SAE #20

5.5. OSCILLATOR TUBE REMOVAL. Replacing an oscillator tube requires the breaking of the seal around the shield and it will then become necessary to reseal the shield. If it becomes necessary to replace an oscillator tube, use a glyptal cement or a generous application of Duco cement to reseal the shield.

5.6. DESICCANT CAPSULE. A silica-gel tube is mounted on top of the oscillator shield. The silica-gel absorbs moisture from within the oscillator and aids in retaining the oscillator calibration. Moisture causes the color of the silica-gel to change from blue to pink. The silica-gel tube is screwed into a hole in the shield. The plastic tube should be replaced by a new tube of silica-gel when all material within the tube has changed from blue to pink. New tubes of silica-gel may be ordered from the Collins Radio Company.

NOTE

The seal around the oscillator tube shield and the silica-gel tube is more easily broken if the parts are warm. This can be done safely with a light bulb or infrared lamp placed close to the oscillator.

5.7. REPLACEMENT OF MAIN CORD.

5.7.1. GENERAL. Because of the necessarily complicated mechanical arrangement of the tuning dial, replacement of the main dial cord is an extensive procedure. Many customers prefer to send the transmitter to an authorized service man or to the Main Factory for dial cord replacement. In general, the unit must be removed from the cabinet and the front panel and dial assembly removed from the chassis.

5.7.2. REMOVAL OF CABINET.

a. Disconnect the AC Cord from the wall receptacle.

b. Remove the terminal covers from the rear of the cabinet and disconnect external wiring.

c. Turn the transmitter on one end and remove any screws from the bottom.

d. Turn the transmitter upright, remove the panel screws and washers and pull the transmitter from the cabinet.

e. Remove the perforated shield from the r-f section.

5.7.3. REMOVAL OF FRONT PANEL.

a. Look into the top of the chassis and watch the geneva assembly drive coupler and turn the ANT LOADING Control until the set screws in the coupler are accessible from the top. Watch the loading capacitor and keep turning the control until a position of the capacitor is reached which can be identified. Now jot down both the number showing at the top of the ANT. LOADING control and the position of the capacitor plates. Do not move the shafts after this. Note the relation between the FINAL TUNING knob and the associated variable capacitor and jot this down.

b. Remove all panel control knobs except the FINAL TUNING and ANT. LOADING.

c. By using a screwdriver at the rear of the panel, carefully shove the style strip clips through and remove the two style strips.

d. Remove the nuts from the tap switch and toggle switches.

e. Remove the connecting wires from the rear of the two meters and remove the adjacent ground wires.

f. Loosen the set screws in the couplers of the PA LOADING shaft, and the FINAL TUNING shaft.

g. Remove all the panel screws (total of nine) except the two in the upper left hand corner and the one above the ANT. LOADING control.

h. Drop panel out and down and remove the pilot light bracket. Set the panel aside.

5.7.4. REMOVAL OF DIAL ASSEMBLY.

a. Disconnect cord from the pointer of the KC dial. Secure the cord so it will not become damaged.

b. Turn the unit up on the right hand end (viewed from front) and loosen the set screws in the slug rack cam flexible coupler.

c. Remove the ground strap from the VFO frame assembly.

d. Turn the unit back in the normal position and remove the VFO power plug assembly; bend it aside.

e. Remove the left hand KC dial light assembly.

f. Loosen the slide rule dial light assemblies and remove the dial lamps. Loosen the associated cable clamps and pull the dial lamp cables free from the dial assembly.

g. Loosen the two forward set screws in the geneva assembly coupler.

h. Remove the dial assembly mounting screws and pull the dial assembly (plus VFO) from the set.

i. Remove the remaining tap switches.

5.7.5. RESTRINGING THE DIAL.

a. Remove the old dial cord.

b. Obtain the dial cord (part number 432 1002 00) and tie a small loop in one end and fasten the washer of the old cord in the other end. The overall length should be 48" long.

c. Turn the KC dial to the counterclockwise stop. Look at the rear of the assembly; the anchor tab is now exposed through a large opening in the rear plate of the dial assembly.

d. Shove the washer end of the dial cord throug the rim of the dial drum and hook the washer o the tab (A). Pull the cord taut.

e. Refer to figure 5-2. With the rear of th dial toward you go around the lower half of th drum (clockwise looking at the rear) and up the left hand pulley (B). Go around this pull toward the right hand pulley.

f. Remove the right hand pulley (D) by extrac ing the mounting screw.

g. Go around the adjacent standoff (C) and th down to the drum.

h. Go around the drum one full turn clockwi and then through the slot in the drum rim a hook the end of the spring on the washer.

i. Take up the slack and bunch it at the ri hand pulley (D) position. Do not force the spr too far.

j. Engage the groove of the right hand pul (D) with the cord, slide the pulley into posit then insert the pulley mounting screw.

k. Check the operation of the cord but ret the KC dial to the counterclockwise stop.

l. Set the KC dial at 0 then attach the slide r dial pointer to the cord as shown in figure 5 Slide the pointer to the extreme left-hand in (viewed from front) of the slide rule dial stake with a few drops of Duco Cement.

m. Apply a thin film of petroleum jelly to pointer slide.

5.7.6. REASSEMBLY.

a. Set the dial assembly in front of the tra mitter.

b. Attach the KC dial light assembly to the left side of the dial.

c. Thrust the EMISSION switch shaft through the back plate, slide the associated lock washer and mounting nut on the shaft, push the shaft on through the front plate, and then tighten the mounting nut.

d. Assemble the loading counter dial into position.

e. Re-fasten the KC dial band-pointer cord and stake with Duco.

f. Shove the dial assembly in place and enter the loading counter dial shaft into the geneva wheel coupler. Fasten the dial assembly to the chassis.

g. Set the transmitter front panel in place, mount the pilot light, then enter the ANT. LOADING and FINAL TUNING capacitors shafts into the couplers.

h. Insert the mounting screws through the panel into the large stand-offs at the top of the dial assembly.

i. Insert the four screws (two in each assembly) at the top front edges of the audio and r-f assemblies but only tighten them halfway.

j. Turn the 32V on the right end (view from front).

k. Turn the slug rack cam until the flat portion of the cam is parallel with the slug rack frame (tip of the cam is up). Set the tuning dial at 7.3 mc.

l. Insert the center portion of the slug rack cam flexible coupler and shove the front panel in. Tighten the screws left loose in step i. of this paragraph.

m. Attach the VFO ground strap then return the transmitter to the normal position.

n. Check against notes to see that the loading capacitor is in the position left in step a. of paragraph 5.7.3. If so, set the knob at the counter-clockwise index and tighten the loading capacitor coupler set screws.

o. Repeat step n. with the FINAL TUNING coupler. (Set the knob at the counter-clockwise index).

p. Check to see that the geneva wheel is in the same position left in step a. of paragraph 5.7.3. If so, rotate the loading counter dial to the position jotted down and tighten the two set screws in the coupler.

q. Mount and tighten all loose switches. Insert and tighten the remaining panel screws.

r. Install the knobs and then the style strips.

s. Reconnect the meter and ground wires.

t. Install the set into the cabinet and make connections.

TYPICAL TEST VOLTAGES

DC Voltages to Ground measured with Volt-ohmyst. Conditions: Phone - No. Mod. Readings taken at LF end of each band.

TUBE	Pin	R.F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V101	6AK6						
G1	1	-17.0	-16.5	-1.0	-0.9	-1.0	-0.9
K	2,7	1.0	1.0	2.9	2.85	2.85	2.9
P	5	235	230	230	225	225	225
G2	6	155	150	65	65	65	65

TUBE	Pin	R. F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V102	6AG7						
K	1,3,5	2.6	2.6	3.9	3.2	3.4	3.2
G1	4	-18.	-18.	-36	-36	-38	-36
G2	6	215	215	205	205	205	210
P	8	230	230	220	220	225	225
V103	7C5						
P	2	235	235	215	210	215	215
G2	3						
G1	6	-24.	-23.	-56.	-21.	-69.	-51.
K	7	25.	25.	27.	27.	26.	26.
V104	7C5						
P	2	225	220	215	215	215	215
G2	3						
G1	6	-115	-110	-170	-175	-150	-150
K	7	-59	-56	-52	-52	-51	-50
V105	RK-4D32						
G2	2	285	300	300	300	295	295
K	4,5	0	0	0	0	0	0
G1	6	-120	-100	-93	-105	-105	-102
P	Cap	690	680	690	690	690	690

DC Voltages to Ground in Audio System (Volt-ohmyst)

4D32 Plate Current = 220 MA Ep = 700 V Key Down

	Audio Amplifier V201, 6SL7GT			Driver V202, 6SN7GT			Modulator V203, & 4, 807	
		PH	CW		PH	CW		PH	CW
Pin 1	G	-0.6	-0.8	G	0	0			
2	P	88	-0.9	P	235	235	G2	235	0
3	K	0	0	K	7.4	7.4	G1	-25	-25
4	G	0	0	G	0	0	K	0	0
5	P	100	100	P	235	235	--	---	---
6	K	0.8	0.8	K	7.4	7.4	P	720	740
7									
8									

Key up - key down conditions of V105 (4D32)
CW operation
f = 7 mc

	Key Up	Key Down
Plate E	820	740
Plate I	0	220
Screen E	300	300

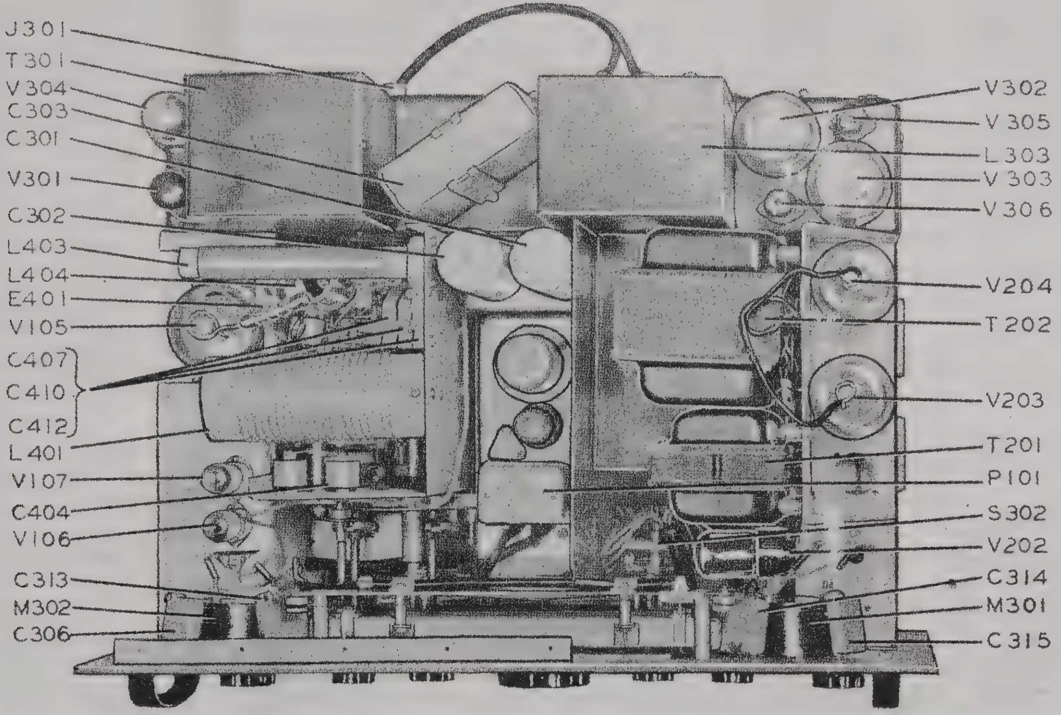


Figure 5-3 Parts Arrangement - Top View

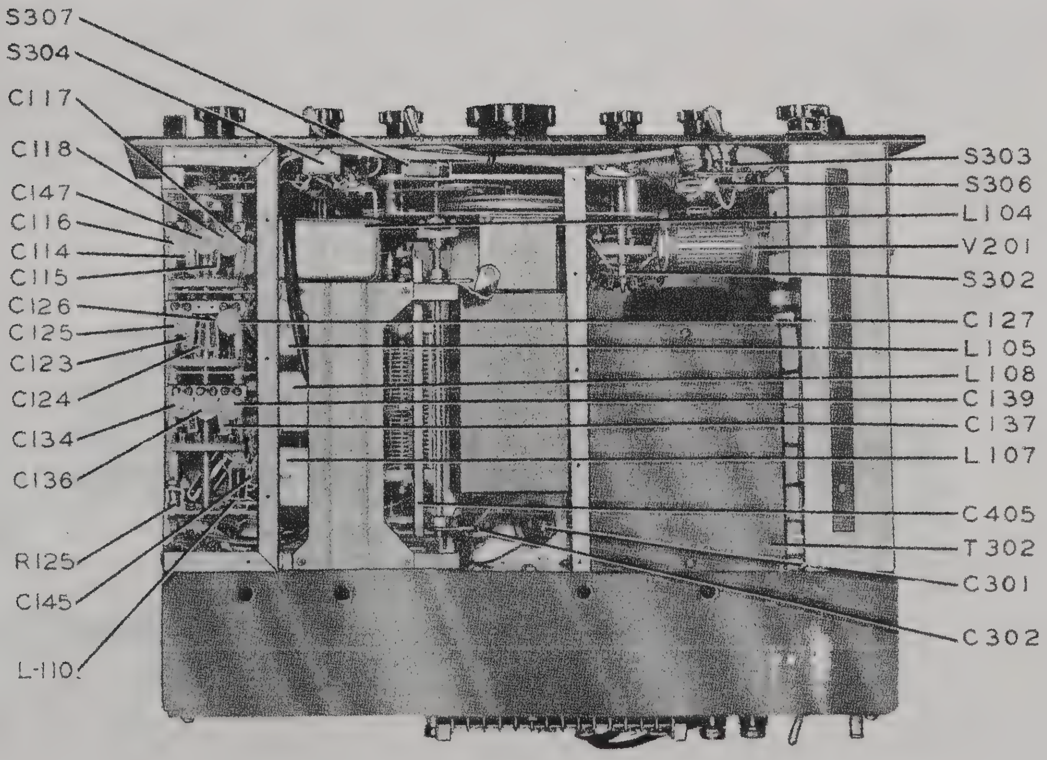


Figure 5-4 Parts Arrangement - Bottom View

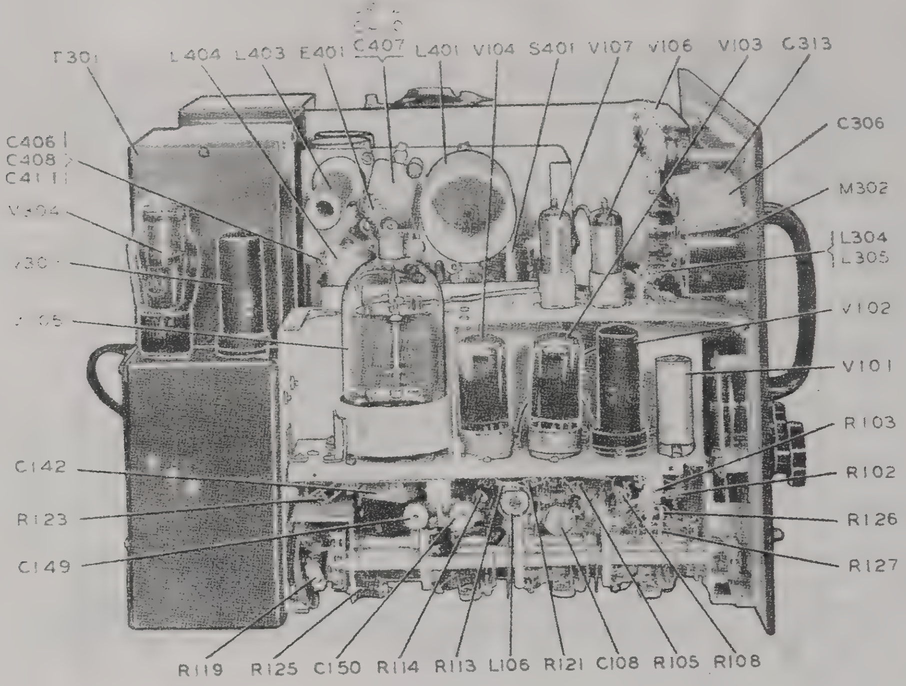


Figure 5-5 Parts Arrangement - Left Side Open

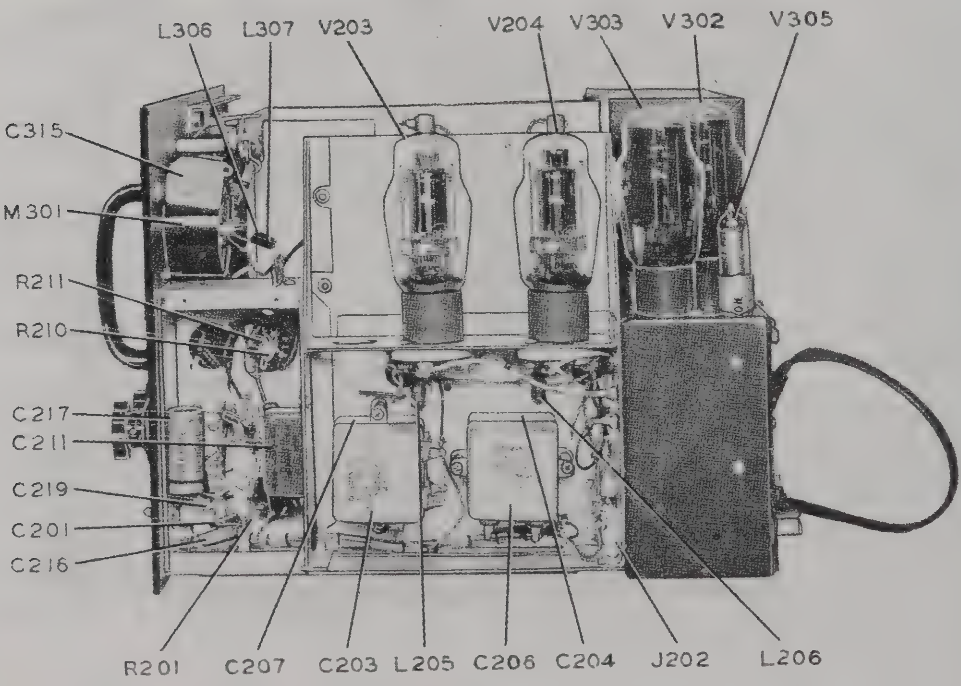


Figure 5-6 Parts Arrangement - Right Side Open

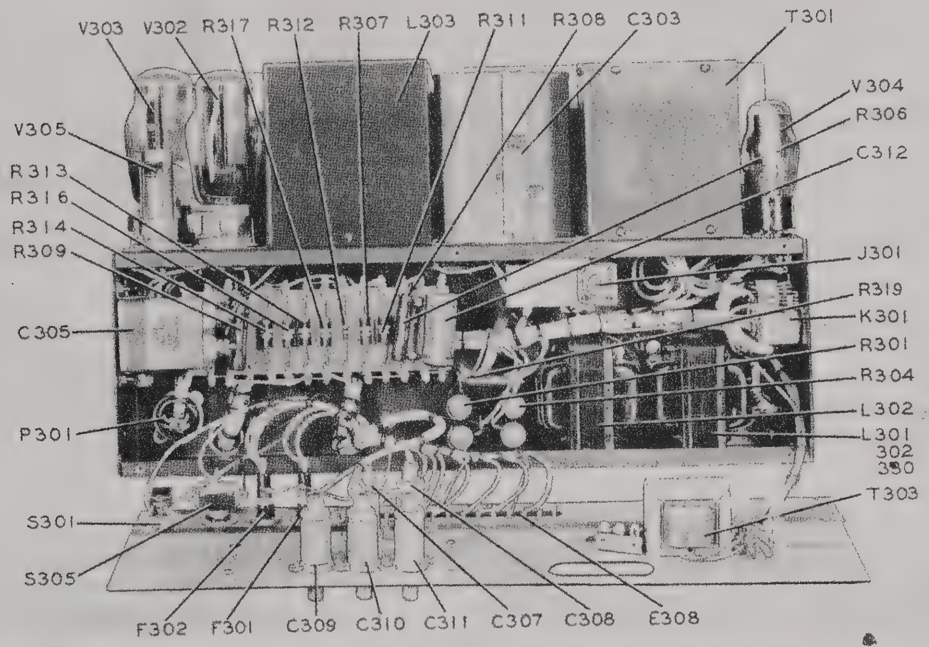


Figure 5-7 Parts Arrangement - Rear Open

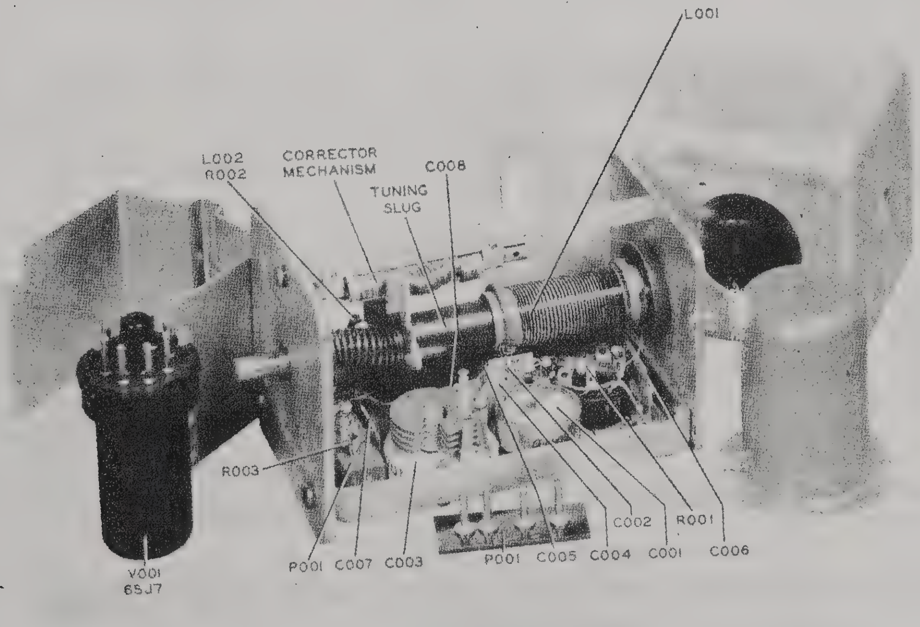
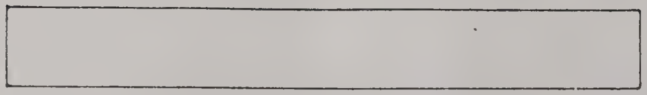
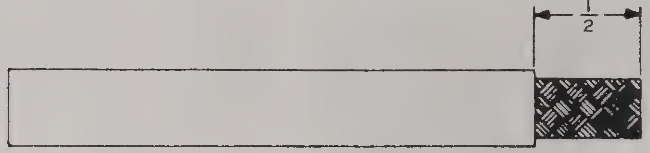


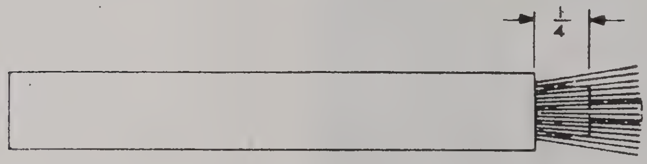
Figure 5-8 Parts Arrangement 70E-8 Open



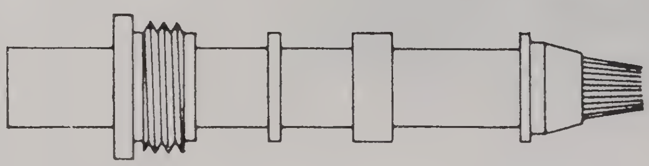
CUT END OF CABLE EVEN.



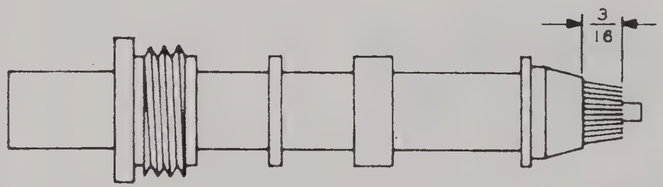
REMOVE VINYL JACKET $\frac{1}{2}$ INCH — DON'T NICK BRAID.



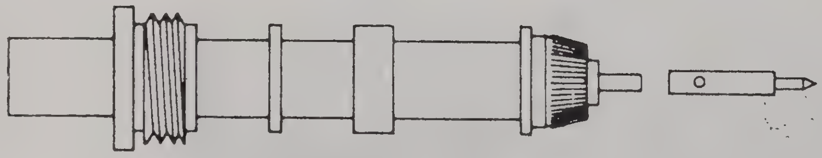
COMB OUT COPPER BRAID AS SHC BARE $\frac{1}{4}$ INCH OF CENTER CONDUCT DON'T NICK CONDUCTOR.



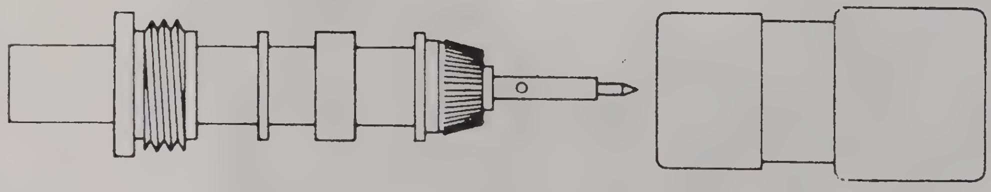
TAPER BRAID AS SHOWN. SLIDE WASHER AND GASKET ON VINYL JA SLIDE CLAMP ON BRAID.



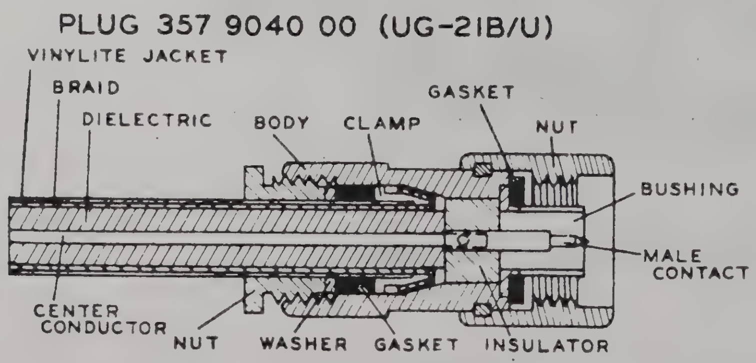
WITH CLAMP IN PLACE, TRIM BR AS SHOWN.



FOLD COPPER BRAID BACK ON CL TIN CENTER CONDUCTO USING MINIMUM AMOUNT HEAT.



HOLDING CONTACT WITH SOFT SOLDER CONTACT T CENTER CONDUCTOR. IT *IMPERATIVE* THAT BACK OF CONTACT BE FLUSH V POLYETHYLENE DIELECTRI NOT USE EXCESS SOLDER CLEAN—SEE THAT END CABLE INSULATOR IS CLE AND FREE OF SOLDER, R AND FOREIGN MATERIAL.



SLIDE BODY INTO PLACE CAREFULL THAT CENTER CONDUCTOR ENTERS IN INSULATOR. FACE OF CABLE ECTRIC MUST FIT FLUSH AGAINST SULATOR. PROPERLY TIGHTEN BC AND NUT WITH WRENCHES.

Figure 5-9 Assembling Plug UG-21B/U to Cable RG-8/U

SECTION VI

PARTS LIST

32V-3 TRANSMITTER

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C101	Buffer Amp Coupling	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C102	Osc. Plate Filter	CAPACITOR: Ceramic; 10,000 mmf p/m 20%; 300 WV	935 2118 00
C103	Buffer Grid Voltage	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C104	Buffer Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C105	Buffer Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C106	Buffer Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C107	1st Mult Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C108	1st Mult Grid By-pass	CAPACITOR: Paper; 100,000 mmf p/m 10%; 400 WV	931 3020 00
C109	1st Mult Cathode	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C110	1st Mult Screen	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C111	Key Click Filter	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C112	2nd Mult Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C113	1st Mult Plate By-pass	CAPACITOR: Mica; 650 mmf p/m 2%; 500 WV	935 5061 00
C114	1st Mult Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 5%; 500 WV	935 0077 00
C115	1st Mult Plate Tuning	CAPACITOR: Mica; 47 mmf p/m 5%; 500 WV	935 0152 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C116	1st Mult Tuning	CAPACITOR: Ceramic 5-25 mmf; 350 WV	917 1036 00
C117	1st Mult Plate Tuning	CAPACITOR: Mica; 180 mmf p/m 5%; 500 WV	935 0116 00
C118	1st Mult Plate Tuning	CAPACITOR: Ceramic 8-50 mmf; 350 WV	917 1038 00
C119	2nd Mult Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C120	2nd Mult Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C121	2nd Mult Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C122	3rd Mult Coupling	CAPACITOR: Ceramic; 100 mf p/m 10%; 500 WV	916 4003 00
C123	2nd Mult Plate Tuning	CAPACITOR: Mica; 20 mmf p/m 5%; 500 WV	935 0076 00
C124	2nd Mult Plate Tuning	CAPACITOR: Mica; 47 mmf p/m 5%; 500 WV	935 0152 00
C125	2nd Mult Plate Tuning	CAPACITOR: Ceramic; 5-25 mmf; 350 WV	917 1036 00
C126	2nd Mult Plate Tuning	CAPACITOR: Mica; 150 mmf p/m 2%; 500 WV	935 0184 00
C127	2nd Mult Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C128	3rd Mult Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C129	3rd Mult Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C130	3rd Mult Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C131	3rd Mult Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C132	3rd Mult Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C133	2nd Mult Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C134	3rd Mult Plate Tuning	CAPACITOR: Ceramic; 5-25 mmf; 350 WV	917 1036 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C135		CAPACITOR: Not Used	
C136	3rd Mult Plate Tuning	CAPACITOR: Ceramic; 5-25 mmf; 350 WV	917 1036 00
C137	3rd Mult Plate Tuning	CAPACITOR: Mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C138		CAPACITOR: Not Used	
C139	3rd Mult Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C140	PA Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C141	PA Grid By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C142	PA Screen By-pass	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C143		CAPACITOR: Not Used	
C144	PA Filament By-pass	CAPACITOR: Mica; 500 mmf p/m 20%; 500 WV	912 0302 00
C145	3rd Mult Plate Blocking	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C147	160 Meter Tap Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C148	80 Meter Tap fixed Tuning	CAPACITOR: Mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C149	80 Meter Tap Var. Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C150	L-108 Trimmer	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C151	Key Filter	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C201	Audio Input RF filter	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C202	Audio Coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C203	V201 Plate By-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00
C204	V201 Plate By-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00
C205	Driver Grid Coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C206	Driver Cathode By-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00
C207	Mod Cathode By-pass	CAPACITOR: Paper; 2 mmf p/m 10%; 600 WV	930 0046 00
C208		CAPACITOR: Not Used	
C209	Microphone input r-f filter	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C210		CAPACITOR: Not Used	
C211	Audio Plate Decoupling	CAPACITOR: Paper; .5 mf p/m 20%; 600 WV	956 2086 40
C212		CAPACITOR: Not Used	
C213		CAPACITOR: Not Used	
C214		CAPACITOR: Not Used	
C215		CAPACITOR: Not Used	
C216	Microphone Coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C217	LV Rect Filter	CAPACITOR: Electrolytic; 10 mf plus 50%; minus 10%; 350 WV	183 1048 00
C218		CAPACITOR: Not Used	
C301	LV Rect Filter	CAPACITOR: Paper; 4 mf plus 40 minus 15%; 600 WV	961 3005 00
C302	LV Rect Filter	CAPACITOR: Paper; 4 mf plus 40 minus 15%; 600 WV	961 3005 00
C303	HV Rect Filter	CAPACITOR: Paper; 8 mf p/m 20%; 1000 WV	930 0150 00
C304		CAPACITOR: Not Used	
C305	HV Filter Tuning	CAPACITOR: Paper; .25 mf p/m 10%; 2000 WV	930 7220 00
C306	Plate Meter By-pass	CAPACITOR: Mica; 150 mmf p/m 20%; 2500 WV	936 0195 00
C307	Noise Suppressor	CAPACITOR: Paper; 0.1 mf plus 20% minus 10%; 600 WV	241 0006 00
C308	Noise Suppressor	CAPACITOR: Paper; 0.1 mf plus 20% minus 10%; 600 WV	241 0006 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C309	Noise Suppressor	CAPACITOR: Paper; 0.1 mf plus 20% minus 10%; 600 WV	241 0006 00
C310	Noise Suppressor	CAPACITOR: Paper; 0.1 mf plus 20% minus 10%; 600 WV	241 0006 00
C311	Noise Suppressor	CAPACITOR: Paper; 0.1 mf plus 20% minus 10%; 600 WV	241 0006 00
C312	Bias Filter	CAPACITOR: Electrolytic; 20 mf 150 WV minus 10% plus 100%	183 1042 00
C313	Plate Meter By-pass	CAPACITOR: Mica; 150 mmf p/m 20%; 2500 WV	936 0195 00
C314	Meter By-pass	CAPACITOR: Mica; 150 mmf p/m 20%; 2500 WV	936 0195 00
C315	Meter By-pass	CAPACITOR: Mica; 150 mmf p/m 20%; 2500 WV	936 0195 00
C401	PA Plate Blocking	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C402	PA Plate By-pass	CAPACITOR: Mica; 2200 mmf p/m 20%; 2500 WV	936 1083 00
C403	Final Tuning	CAPACITOR: Variable Air Dielectric; Dual Sect; 10-150 mmf per sect	920 0011 00
C403A	Part of C403	CAPACITOR: Section of C403	
C403B	Part of C403	CAPACITOR: Section of C403	
C404	Final Tuning	CAPACITOR: Ceramic; 50 mmf p/m 10%; WV; 2500 v rms at 2 mc 1000 v rms at 16 mc	913 4503 20
C405	Antenna Loading	CAPACITOR: Variable air-dielectric single sect; 15-300 mmf	920 0014 00
C406	Antenna Loading	CAPACITOR: Mica; 470 mmf p/m 10%; 2500 WV	936 0226 00
C407	Antenna Loading	CAPACITOR: Mica; 470 mmf p/m 5%; 2500 WV	936 0226 00
C408	Antenna Loading	CAPACITOR: Mica; 910 mmf p/m 10%; 2500 WV	936 0246 00
C409	Final Tuning	CAPACITOR: Ceramic; 50 mmf p/m 10%; WV; 2500 v rms at 2 mc 1000 v rms at 16 mc	913 4503 20

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C410	Antenna Loading	CAPACITOR: Mica; 910 mmf p/m 10%; 2500 WV	936 0246 00
C411	Antenna Loading	CAPACITOR: Mica; 470 mmf p/m 10%; 2500 WV	936 0226 00
C412	Antenna Loading	CAPACITOR: Mica; 470 mmf p/m 10%; 2500 WV	936 0226 00
C413	Trap Tuning	CAPACITOR: Ceramic; 67 mmf p/m 5%; 5000 WV; p/o E-401	913 0090 00
E304	Wire Tie Point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/ solder lug 17/32" lg	190 1103 00
E305	Wire Tie Point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/ solder lug 17/32" lg	190 1103 00
E306	Wire Tie Point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/ solder lug 17/32" lg	190 1103 00
E307	Wire Tie Point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/ solder lug 17/32" lg	190 1103 00
E308	Rear Terminal Strip	CONNECTOR: 14 term, barrier type strip w/ lugs on back	367 0022 00
E401	Parasitic Suppressor	PA TRAP ASSEM: 1-1/3 turns tinned #14 wire, 100 ohm 10w resistor, 67 mmf capacitor (incl C413, L405)	505 4443 002
F301	LV and Filament	FUSE: 3 amp; 250 v	264 4080 00
F302	High Voltage	FUSE: 5 amp; 250 v	264 4090 00
I301	Pilot Lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
I302	Pilot Lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
	For I302	JEWEL: Pilot light red faceted	262 2110 00
I303	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I304	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I305	Dial Lamp	BULB: Pilot light; 6 v, .2 amp midget fl base; T1-3/4 bulb	262 0023 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
I306	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I307	Dial Lamp HE	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I308	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I309	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I310	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
I311	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base, T1-3/4 bulb	262 0023 00
I312	Dial Lamp	BULB: Pilot light; 6 v, .2 amp; midget fl base; T1-3/4 bulb	262 0023 00
J101	Key	JACK: Phone single circuit, midget	360 0008 00
J102	Cable	CONNECTOR: Std octal socket	220 1850 00
J201	Microphone	CONNECTOR: 2 female cont; wall mtg	369 1004 00
J202	Modulator	CONNECTOR: Std octal socket	220 1850 00
J301	Antenna Connector	CONNECTOR: Single round female cont	357 9003 00
K301	Carrier Control	RELAY: Circuit control; cont 1A1B1A and 2A; 48 v coil	970 1014 00
L101	Osc plate choke	COIL: RF choke; 4 pi; duo-log wnd; 2.5 mh p/m 20%; .125 amp	240 2100 00
L102		COIL: Not Used	
L103	Buffer Plate Choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wnd	240 0042 00
L104	1st Mult Tuning	COIL: LF; 38T #28 wire	503 2896 002
L105	2nd Mult Tuning	COIL: MF; 17.3T #28 wire	503 2895 002
L106	2nd Mult Plate Choke	COIL: RF choke; 2 pi; duo-lat wnd; 208 uh	240 6000 00
L107	3rd Mult Tuning	COIL: HF 7.6T #28 wire	503 2835 001
L108	3rd Mult Tuning	COIL: LF; 38T #28 wire	503 2896 002

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L109	PA Grid Choke	COIL: RF choke; 4 pi; duo-lat wnd; 2.5 mh p/m 20%; .125 amp	240 2100 00
L110	3rd Mult Tuning	COIL: 23T #26 Wire	503 4512 001
L111	1st Mult Plate Choke	COIL: RF choke; 3 pi; universal wnd; 1 mh plus 20 minus 10%	240 0047 00
L112	3rd Mult Plate Choke	COIL: RF choke; 3 pi; universal wnd; 1 mh plus 20 minus 10%	240 0047 00
L113	Key Filter	COIL: RF choke; 2.7 mh, 300 ma; 45 turns #30 AWG wire	240 0012 00
L114		COIL ASSEMBLY: 21 mc; 15 turns 15 turns per inch #24 DE wire	505 9138 002
L201		COIL: Not used	
L202		COIL: Not used	
L203		COIL: Not used	
L204		COIL: Not used	
L205	Modulator Plate Choke	COIL: RF choke; 500 uh p/m 10%; 4 pi, universal wnd	240 0042 00
L206	Modulator Plate Choke	COIL: RF choke; 500 uh p/m 10%; 4 pi universal wnd	240 0042 00
L207	PTT Line Filter	COIL: RF choke; 2.7 mh, 300 ma, 45 turns #30 AWG wire	240 0012 00
L301	LV Filter	REACTOR, FILTER: 11 hy p/m 15%	668 0012 00
L302	LV Filter	REACTOR, FILTER: 11 hy p/m 15%	668 0012 00
L303	HV Filter	REACTOR, FILTER: 5 hy p/m 15%	668 0055 00
L304	PA Meter Filter Choke	COIL: RF choke; 2.7 mh, 300 ma, 45 turns #30 AWG wire	240 0012 00
L305	PA Meter Filter Choke	COIL: RF choke; 2.7 mh, 300 ma, 45 turns #30 AWG wire	240 0012 00
L306	Meter Filter Choke	COIL: RF choke; 2.7 mh, 300 ma, 45 turns #30 AWG wire	240 0012 00
L307	Meter Filter Choke	COIL: RF choke; 2.7 mh, 300 ma, 45 turns #30 AWG wire	240 0012 00
L401	PA Plate Tuning	COIL: LF tank; 20T #14 wire	503 2892 002

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L402	PA Plate Tuning (28 mc)	COIL: HF tank; 5T silver pl copper tubing	503 2831 001
L403	PA Plate Choke	COIL: RF choke; 165 turns of #27 chrome oxide wire	505 6796 003
L404	Network Coil	COIL: output; 32 turns; #18 wire	503 6486 001
L405	Trap Tuning	COIL: PA Trap Assem (E401)	505 4452 002
M301	Mult Purpose	METER: 0-5 ma DC; 50 scale divisions; marked 0-250, 0-500, 0-1000	458 0211 00
M302	PA Plate	METER: 0-500 ma DC; 50 scale divisions	450 1500 00
P101	Osc. Power	CONNECTOR: 4 prong plug; part of oscillator filter assem	503 2868 002
P201	Microphone	CONNECTOR: 2 prong plug	369 1005 00
P301	Modulator power	CONNECTOR: Std 8 term octal plug	369 1009 00
P302	RF circuits power	CONNECTOR: Std 8 term octal plug	369 1009 00
P303		CONNECTOR: Not Used	
P304	Antenna Plug	CONNECTOR: Single round male contact	357 9040 00
R101		RESISTOR: Not Used	
R102	Buffer Grid	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R103	Buffer Cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R104	Buffer Screen	RESISTOR: .33 meg p/m 10%; 1/2 w	745 1191 00
R105	V101, V102, V103 grid	RESISTOR: .10 meg p/m 10%; 1/2 w	745 1170 00
R106	1st Mult Grid	RESISTOR: .10 meg p/m 10%; 1/2 w	745 1170 00
R107	1st Mult Cathode	RESISTOR: 820 ohm p/m 10%; 1/2 w	745 1083 00
R108	1st Mult Screen	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R109	1st Mult Plate Decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R110	2nd Mult Grid	RESISTOR: .10 meg p/m 10%; 1/2 w	745 1170 00
R111	2nd Mult Screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R112	2nd Mult Plate Decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R113	3rd Mult Grid	RESISTOR: .10 meg p/m 10%; 1/2 w	745 1170 00
R114	3rd Mult Screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R115	3rd Mult Plate Decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R116	3rd Mult Plate Decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R117	3rd Mult Grid Stabilizer	RESISTOR: 10 ohm p/m 10%; 1/2 w	745 1002 00
R118	2nd Mult Cathode	RESISTOR: 1500 ohm p/m 10%; 1/2 w	745 1093 00
R119	PA Grid Meter Shunt	RESISTOR: 6.2 ohm p/m 5%; 1/2 w	707 0104 00
R120	PA Grid	RESISTOR: 3300 ohm p/m 10%; 1 w	745 3107 00
R121	3rd Mult Grid Voltage Divider	RESISTOR: .22 meg p/m 10%; 1/2 w	745 1184 00
R122	3rd Mult Grid Return	RESISTOR: 680 ohm p/m 10%; 2 w	745 5079 00
R123	PA Screen Stabilizer	RESISTOR: 47 ohm p/m 10%; 1 w	745 3030 00
R124		Not Used	
R125	Dial Light Dropping	RESISTOR: 2 ohm p/m 10%; 2 w	710 1070 00
R126	Voltage Regulator Dropping	RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R127	Voltage Regulator Dropping	RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R128	V-104 plate dropping	RESISTOR: 4700 ohm p/m 10%; 2 w	745 5114 00
R129	V-104 plate dropping	RESISTOR: 4700 ohm p/m 10%; 2 w	745 5114 00
R203		RESISTOR: Not Used	
R204	V201 Cathode	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R205	Audio Gain Control	RESISTOR: .5 meg p/m 20%; 1/2 w	376 3027 00
R206	V201 Plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R207	V201 Plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R208	V201 Plate Decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R209	V201 Plate Decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R210	V202 Grid	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R211	V202 Cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R212	thru R215	RESISTOR: Not Used	
R216	Audio Decoupling	RESISTOR: 2200 ohm p/m 10%; 1 w	745 3100 00
R301	V105 Screen Dropping	RESISTOR: 12,000 ohm p/m 5%; 25 w	710 0366 00
R302		RESISTOR: 33,000 ohm p/m 10%; 1/2 w	745 1149 00
R303		RESISTOR: 39,000 ohm p/m 10%; 1/2 w	745 1153 00
R304	V105 Screen Bleeder	RESISTOR: 25,000 ohm p/m 10%; 25 w size	710 3254 20
R305	Mod Bias Control	RESISTOR: Variable; WW; 1000 ohm p/m 10%; 4 w	377 0007 00
R306	Bias Bleeder	RESISTOR: 750 ohm p/m 5%; 10 w	710 1750 10
R307	LV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R308	LV Meter Shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R309	Relay Voltage Divider	RESISTOR: 5000 ohm p/m 10%; 10 w	710 1542 00
R310	Relay Voltage Divider	RESISTOR: 7500 ohm p/m 10%; 10 w	710 0033 00
R311	LV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R312	HV Meter Shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R313	HV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R314	HV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R315	Mod. Plate Shunt	RESISTOR: WW; 0.51 ohm p/m 5%; 1/2 w	707 0026 00
R316	HV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R317	HV Bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R318	Mod. Ind Shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R319	Voltage Regulator Dropping	RESISTOR: 2000 ohm p/m 10%; 10 w	710 1242 00
R320	Series Tuning	RESISTOR: WW; 15 ohm p/m 10%; 25 w	710 3152 00
R321	Series Tuning	RESISTOR: WW; 15 ohm p/m 10%; 25 w	710 3152 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S101	Band Change Switch	SWITCH: 8 pole, 5 position, 4 sect; non-shorting	503 2923 004
S101A		SWITCH: Part of S101	
S101B		SWITCH: Part of S101	
S101C		SWITCH: Part of S101	
S101D		SWITCH: Part of S101	
S101E		SWITCH: Part of S101	
S101F		SWITCH: Part of S101	
S101G		SWITCH: Part of S101	
S101H		SWITCH: Part of S101	
S301	Cabinet Interlock	SWITCH: SP Normally open	260 0526 00
S302	Emission Selector	SWITCH: Band-change; 8 pole; 3 position 3 sect; non-shorting	259 0264 00
S302A		SWITCH: Part of S302	
S302B		SWITCH: Part of S302	
S302C		SWITCH: Part of S302	
S302D		SWITCH: Part of S302	
S302E		SWITCH: Part of S302	
S302F		SWITCH: Not Used	
S302G		SWITCH: Not Used	
S302H		SWITCH: Not Used	
S303	High Voltage Switch	SWITCH: SPST toggle; 25 amp.	266 1040 00
S304	Low Voltage Switch	SWITCH: SPST toggle; 25 amp.	266 1040 00
S305	600-700 v selector	SWITCH: DPDT toggle; 1 amp 250 v, 3 amp 125 v	260 0551 00
S306	Meter Selector	SWITCH: Band change; 2 pole, 5 position, 1 sect; non-shorting	259 0045 00
S306A		SWITCH: Part of S306	
S306B		SWITCH: Part of S306	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S307	Tune-Operate switch	SWITCH: SPST toggle; 3 amp 250 v	260 0857 00
S401	PA Plate Circuit	SWITCH: Band change; 2 pole, 5 position 1 sect; shorting	259 0043 00
S401A		SWITCH: Part of S401	
S401B		SWITCH: Part of S401	
S402	Antenna Loading	SWITCH: Band change; 6 position, shorting type	269 1248 00
T201	Modulator input	TRANSFORMER: Driver; pri; 12,000 ohm, secd; 5300 ohm CT, freq response 300-3500 cps p/m 3 db.	667 0011 00
T202	Modulation	TRANSFORMER: Mod; pri; 7000 ohm CT, 100 ma DC max, bal; secd; 500/3750 ohm, 200 ma DC, unbalanced; freq response 300/3500 cps p/m 3 db; 60 w	667 0010 00
T301	Low Voltage	TRANSFORMER: pri; 115 v, secd #1; 850 v CT, secd #2; 5 v, 4 amp, secd #3; 5 v, 4 amp, secd #4; 6.3 v, 9 amp 50/60 cps.	662 0009 00
T302	High Voltage	TRANSFORMER: Power; 50/60 cps; pri; 115 v, secd; 1100 v CT, w/ pri leads #1 and #2 on 115 v, secd leads #4 and #6 should be 1370 v rms.	662 0014 00
T303		TRANSFORMER: Filament; 60 cps, pri 107 v CT, 6.3 v secd; 1000 v RMS	662 0112 00
V101	Buffer Amp.	TUBE: Type 6AK6; power amp pentode; miniature	257 0041 00
V102	1st Multiplier	TUBE: Type 6AG7; video power amp pentode	255 0039 00
V103	2nd Multiplier	TUBE: Type 7C5; beam power amp; octalox	255 0141 00
V104	3rd Multiplier	TUBE: Type 7C5; beam power amp; octalox	255 0141 00
V105	Power Amplifier	TUBE: Type RK 4D32; tetrode	266 0078 00
V106	Oscillator Voltage Regulator	TUBE: OA2 voltage regulator	257 0052 00
V107	Oscillator Voltage Regulator	TUBE: OB2 voltage regulator	257 0058 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
V201	1st and 2nd Audio	TUBE: Type 6SL7GT; twin triode amp	255 0040 00
V202	Audio Driver	TUBE: Type 6SN7GT; twin triode amp	255 0033 00
V203	Modulator	TUBE: Type 807, transmitting beam power amp	255 0033 00
V204	Modulator	TUBE: Type 807, transmitting beam power amp	255 0033 00
V301	Low Voltage Rectifier	TUBE: Type 5Z4; full wave hi-vac rect	255 0084 00
V302	High Voltage Rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	257 0020 00
V303	High Voltage Rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	257 0020 00
V304	Bias Voltage Regulator	TUBE: Type OA3/VR-75; voltage regulator	257 0008 00
V305	Screen Voltage Limiter	TUBE: Type OA2; voltage limiter	257 0052 00
V306	Screen Voltage Limiter	TUBE: Type OA2; voltage limiter	257 0052 00
XF301	Holder for F301	HOLDER, FUSE: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XF302	Holder for F302	HOLDER, FUSES: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XI301	Mtg for I301	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
XI302	Mtg for I302	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
XV101	Socket for V101	SOCKET, TUBE: Miniature shielded 7 pin	220 1069 00 alt. 220 1068 00
XV102	Socket for V102	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV103	Socket for V103	SOCKET, TUBE: Loctal, bakelite	220 1002 00
XV104	Socket for V104	SOCKET, TUBE: Loctal, bakelite	220 1002 00
XV105	Socket for V105	SOCKET, TUBE: 7 prong ceramic w/ clips	220 1072 00
XV106	Socket for V106	SOCKET, TUBE: Miniature shielded, 7 pin	220 1069 00 alt. 220 1068 00
XV107	Socket for V107	SOCKET, TUBE: Miniature shielded, 7 pin	220 1069 00 alt. 220 1068 00
XV201	Socket for V201	SOCKET, TUBE: Octal, bakelite	220 1850 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XV202	Socket for V202	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV203	Socket for V203	SOCKET, TUBE: 5 prong ceramic w/ clips	220 5520 00
XV204	Socket for V204	SOCKET, TUBE: 5 prong ceramic w/ clips	220 5520 00
XV301	Socket for V301	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV302	Socket for V302	SOCKET, TUBE: Octal ceramic w/ clips and key way	220 5810 00
XV303	Socket for V303	SOCKET, TUBE: Octal ceramic w/ clips and key way	220 5810 00
XV304	Socket for V304	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV305	Socket for V305	SOCKET, TUBE: Miniature, 7 term	220 1068 00
XV306	Socket for V306	SOCKET, TUBE: Miniature, 7 term	220 1068 00

SECTION VII

ANTENNAS WITH 52-OHM COAXIAL FEED LINES

7.1. GENERAL DISCUSSION.

This section pertains to some antennas which may be used with the 32V amateur transmitter.

The advantages of using these antennas are listed below:

a. Broadband

b. Coaxial feed system provides shielding for TVI, grounding of TVI, and shielding for better signal to noise ratio at the receiver input terminals.

c. The half-wave dipole antennas attenuate some spurious radiation and the half-wave dipole feed lines attenuate spurious radiation at TV frequencies.

d. No added tuning controls are necessary.

e. Coaxial connectors provide a convenient means of transferring antennas.

7.2. ANTENNA DETAILS.

The table following gives the nominal performance expected from the antennas described in this section.

Nominal Antenna Performance Specifications

	FIGURE 7-2	FIGURE 7-3	FIGURE 7-4	FIGURE 7-5
ANTENNA ITEM	10-Meter Beam	20-Meter Beam	40-Meter Dipole	80-Meter Dipole
Frequency range	26.96 to 29.7 mc	14.0 to 14.4 mc	7.0 to 7.3 mc	3.5 to 4.0 mc
Front to back ratio	4 to 1	10 to 1	----	----
Gain over half-wave dipole	6.75 db	5.1 db	----	----
SWR	1.1 at band ctr.			
	2.1 at band ends	1.8 at band ends	1.8 at band ends	2.5 at band ends

The 32V amateur transmitter is designed with an unbalanced output to secure the advantages of pi and L networks; notable of which is reduction of harmonic radiation, particularly on television frequencies.

The 32V amateur transmitter antenna output circuit is designed to work into an unbalanced resistive load of 52 ohms with a maximum standing wave ratio of 2.5 to 1. Hence, the transmission line must incorporate a method of line balancing in order to match between the unbalanced output circuits and a balanced radiator. Figures 7-2 and 7-3 show construction details of beams for use on 10 or 11 and 20 meters. Each beam is constructed with a balanced to unbalanced transformer (balun) to match the beams to a coaxial feed line. Figures 7-4 and 7-5 show construction details of horizontal dipoles for use on 40 and 80 meters. Each dipole is constructed with a balun to match the dipole to a coaxial feed line. If it is desired to use shorter length baluns than those shown for the 40 and 80 meter dipoles, refer to figure 7-6, Short Balun for 40 and 80 Meters.

The 100 mmf ceramic capacitor used in the 10 and 20 meter beams is described below. The r-f current flowing in this capacitor at 10 meters is 6 amperes; at 20 meters, 3 amperes. These capacitors are adequate for 1-KW transmitters.

CAPACITORS: Ceramic, 100 mmf ±10%, 5000-VDCW. Collins part number 913 0821 00 or Centralab Type 850A.

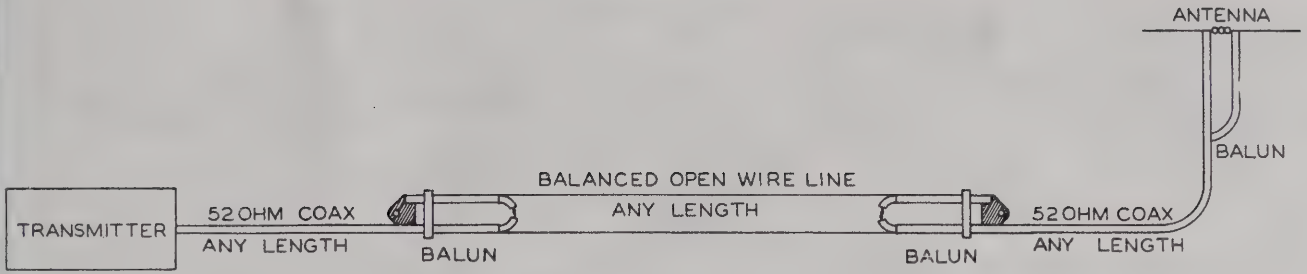
7.3. TRANSMISSION LINE.

At some installations a long transmission line will be necessary. For lowest transmission line losses, a high impedance open wire balanced line is recommended. To secure the advantage of the low losses of an open wire line, it is necessary to use an unbalanced to balanced impedance matching transformer (balun) to transfer from the unbalanced low impedance output termination, provided on the 32V, to a high impedance open wire balanced line. Figure 7-1 indicates the construction details of a balun for this purpose.

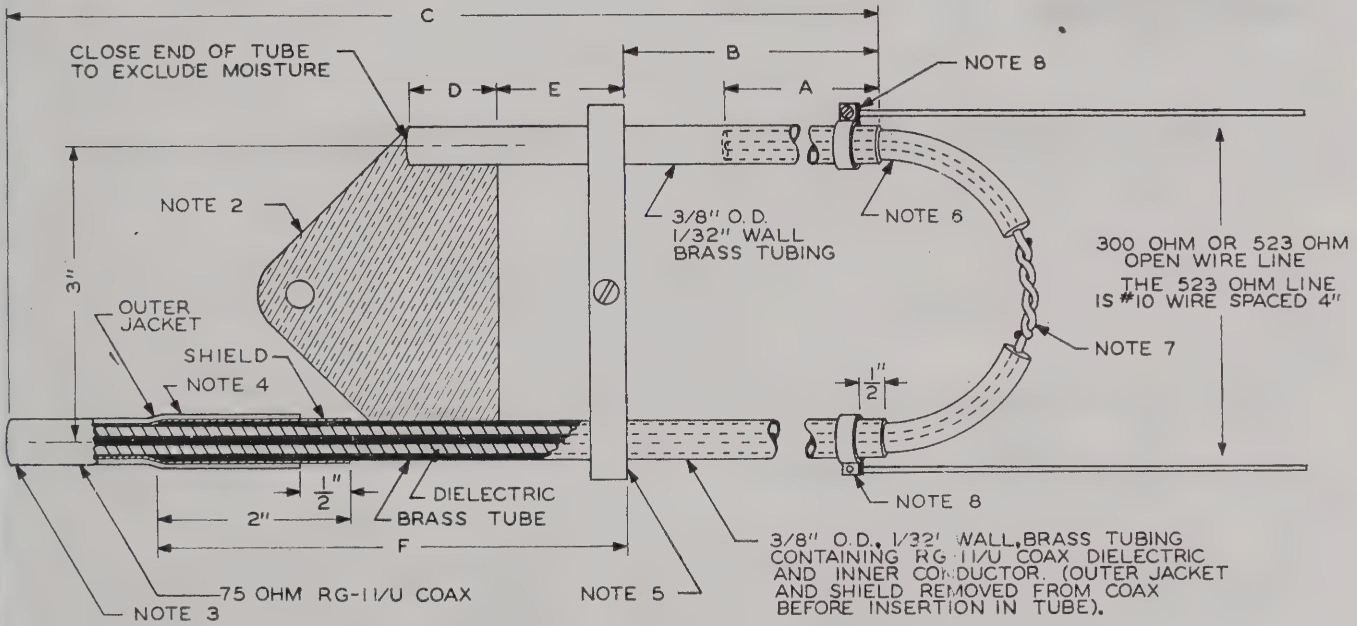
7.4. TEST INFORMATION.

All baluns mentioned in this discussion are resonant circuits The baluns are cut to operate at the center frequency of the band specified.

If it is desired to check any balun, disconnect the antenna from the balun, and the center conductor of the feed cable from the shield of the opposite cable. Use a grid dip meter, or other means, to check for resonance. If the balun is off frequency, correction may be made by either changing the length of the balun or changing the value of the capacity used. The resonant frequency may also be varied by altering the spacing between cables. The length of the balun must not exceed one quarter wave-length, and baluns shorter than those given in figure 7-6 are not recommended.



THIS SYSTEM PERMITS USE OF A BALANCED OPEN WIRE LINE TO REDUCE LOSSES ON LONG TRANSMISSION LINES. CONSTRUCTION DETAILS OF THE UNBALANCED TO BALANCED IMPEDANCE MATCHING TRANSFORMER (BALUN) USED BETWEEN THE OPEN WIRE LINE AND THE 52 OHM RG-8/U COAXIAL CABLE ARE SHOWN BELOW.


C
B
A
D
E
CLOSE END OF TUBE TO EXCLUDE MOISTURE
NOTE 8
NOTE 2
3/8" O.D. 1/32" WALL BRASS TUBING
NOTE 6
300 OHM OR 523 OHM OPEN WIRE LINE
THE 523 OHM LINE IS #10 WIRE SPACED 4"
3"
OUTER JACKET
SHIELD
NOTE 4
NOTE 7
1/2"
1/2"
DIELECTRIC
2"
BRASS TUBE
F
NOTE 8
75 OHM RG-11/U COAX
NOTE 3
NOTE 5
3/8" O.D., 1/32" WALL, BRASS TUBING CONTAINING RG-11/U COAX DIELECTRIC AND INNER CONDUCTOR. (OUTER JACKET AND SHIELD REMOVED FROM COAX BEFORE INSERTION IN TUBE).

NOTES:

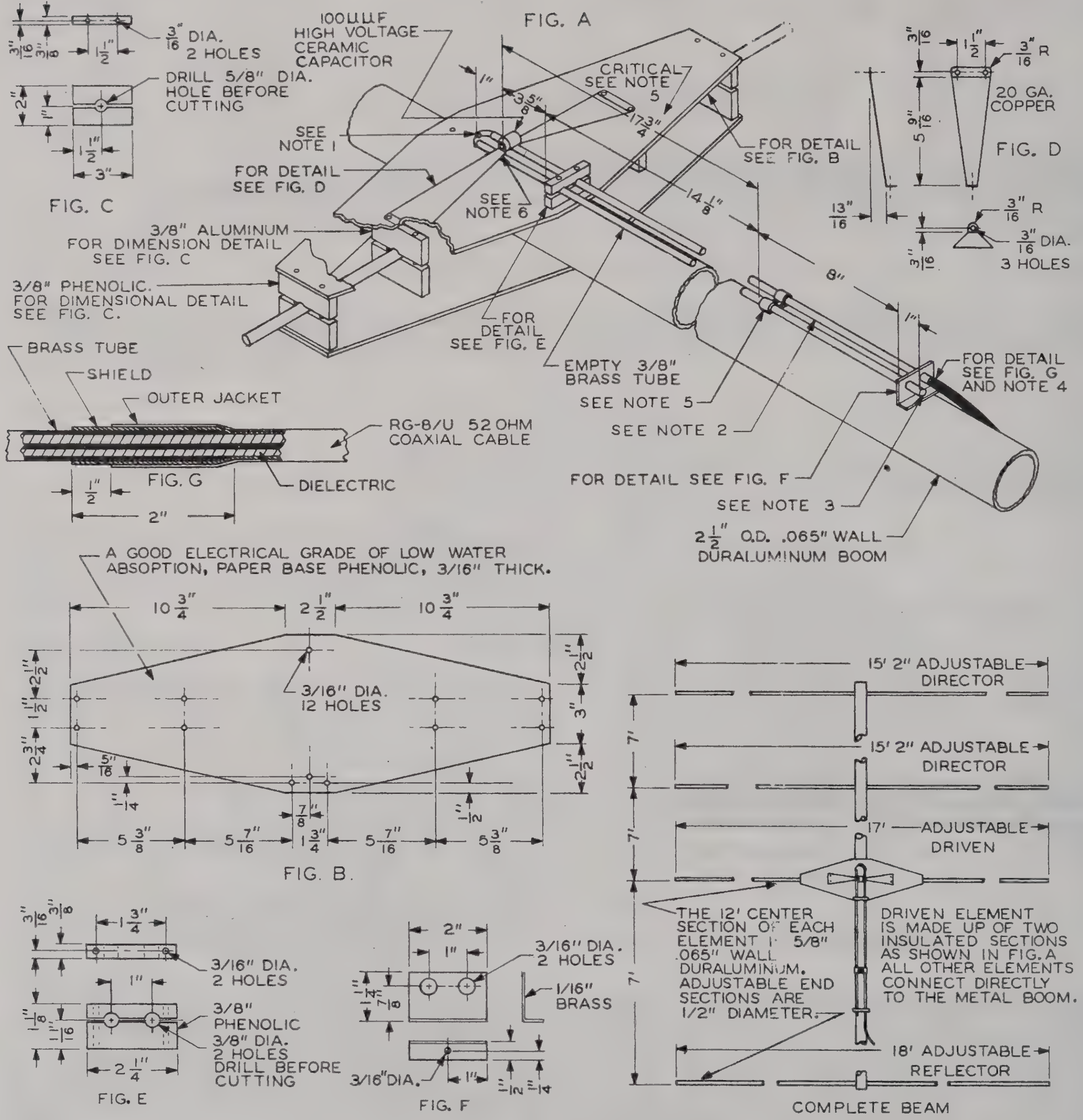
1.

FREQ. MC.	OPEN WIRE LINE IMPEDENCE	LENGTH - INCHES		
		A	B	C
27 TO 29.7	300 OHMS	15 3/8	38 1/4	69 5/8
27 TO 29.7	523 OHMS	10 5/8	44 1/2	69 5/8
14 TO 14.3	523 OHMS	21 1/4	92 1/4	139

DIMENSIONS D, E, AND F ARE NOT CRITICAL AND MAY BE ADAPTED TO THE INDIVIDUAL INSTALLATION DIMENSION D SHOULD BE LONG ENOUGH TO PERMIT SILVER SOLDERING BRASS PLATE AND TUBES TOGETHER. DIMENSION E SHOULD BE LONG ENOUGH TO PERMIT ADJUSTMENT OF THE SHORTING BAR. DIMENSION F SHOULD BE LONG ENOUGH TO PROVIDE SUFFICIENT OVERHANG FOR CONNECTING THE RG-11/U CABLE.

2. BRASS PLATE OF CONVENIENT SIZE SILVER SOLDERED TO THE TWO BRASS TUBES. PLATE MAY BE GROUNDED OR UNGROUNDED AND IS DESIGNED TO SECURE THE BALUN TO AN END SUPPORT.
3. ATTACH A COAX CONNECTOR HERE TO PERMIT ATTACHING A LENGTH OF 52 OHM RG-8/U COAX.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-11/U 75 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2 INCH SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. COVER THE AREA WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THIS SHORTING BAR SHOULD BE MOVABLE TO PERMIT ADJUSTING THE BALUN TO REDUCE THE OVERALL STANDING WAVE RATIO OF THE SYSTEM.
6. REMOVE THE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAX. INSERT THE PROPER LENGTH OF BARE DIELECTRIC INSIDE THE TUBE.
7. SOLDER INNER CONDUCTORS TOGETHER. COVER THE TUBE ENDS AND ALL OF THE CABLE BETWEEN WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
8. INSTALL A BRACKET FOR ATTACHING THE OPEN WIRE LINE. IF BRACKET IS SOLDERED, BE VERY CAREFUL TO AVOID OVERHEATING AND DAMAGING THE DIELECTRIC.

Figure 7-1 Balun with Balanced Open Wire Line for Reduction of Losses on Long Transmission Lines



NOTES:

1. ALLOW COAXIAL CABLE DIELECTRIC MATERIAL TO EXTEND FROM TUBE. SOLDER COAX INNER CONDUCTOR TO END OF OTHER TUBE. WRAP COAX DIELECTRIC MATERIAL AND END OF BOTH TUBES WITH SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE. MAKE A CONTINUOUS WRAPPING ALONG THE DIELECTRIC FROM ONE TUBE TO THE OTHER.
2. 3/8" BRASS TUBE CONTAINING COAX CABLE MINUS JACKET AND SHIELD.
3. CLOSE END OF TUBE TO EXCLUDE MOISTURE.
4. REMOVE OUTER JACKET AND SHIELD FROM A LENGTH OF RG-8/U 52 OHM COAXIAL CABLE. CUT THE OUTER JACKET 1/2" SHORTER THAN THE SHIELD. BEVEL THE OUTER EDGE OF THE 3/8" O.D. BRASS TUBE. SLIDE THE DIELECTRIC INSIDE THE THE TUBE. FORCE THE BEVELED END OF THE BRASS TUBE BETWEEN THE DIELECTRIC AND THE SHIELD FOR A DISTANCE OF ABOUT 2 INCHES AS SHOWN. SOLDER THE SHIELD TO THE TUBE, USING A MINIMUM AMOUNT OF HEAT TO AVOID DAMAGING THE DIELECTRIC. HOLD THE CABLE STRAIGHT WHILE SOLDERING. COVER THE AREA WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.
5. THE DISTANCE BETWEEN THE SHORTING BAR AND THE CAPACITOR IS CRITICAL. BEFORE INSERTING THE COAXIAL CABLE, AND BEFORE CONNECTING THE COPPER TRIANGLE TO THE ELEMENT, USE A GRID-DIP OSCILLATOR TO RESONATE THE BALUN TO THE CENTER OF THE BAND. THE 17 3/4" DIMENSION IS APPROXIMATELY CORRECT.
6. SOLDER 100 µµF HIGH VOLTAGE CERAMIC CAPACITOR TO END OF 20 GA. COPPER TRIANGLE. SOLDER COPPER TRIANGLE TO BRASS TUBE.

Figure 7-2 10 Meter Beam with Shortened Unbalanced to Balanced Transformer (Balun) Feed System

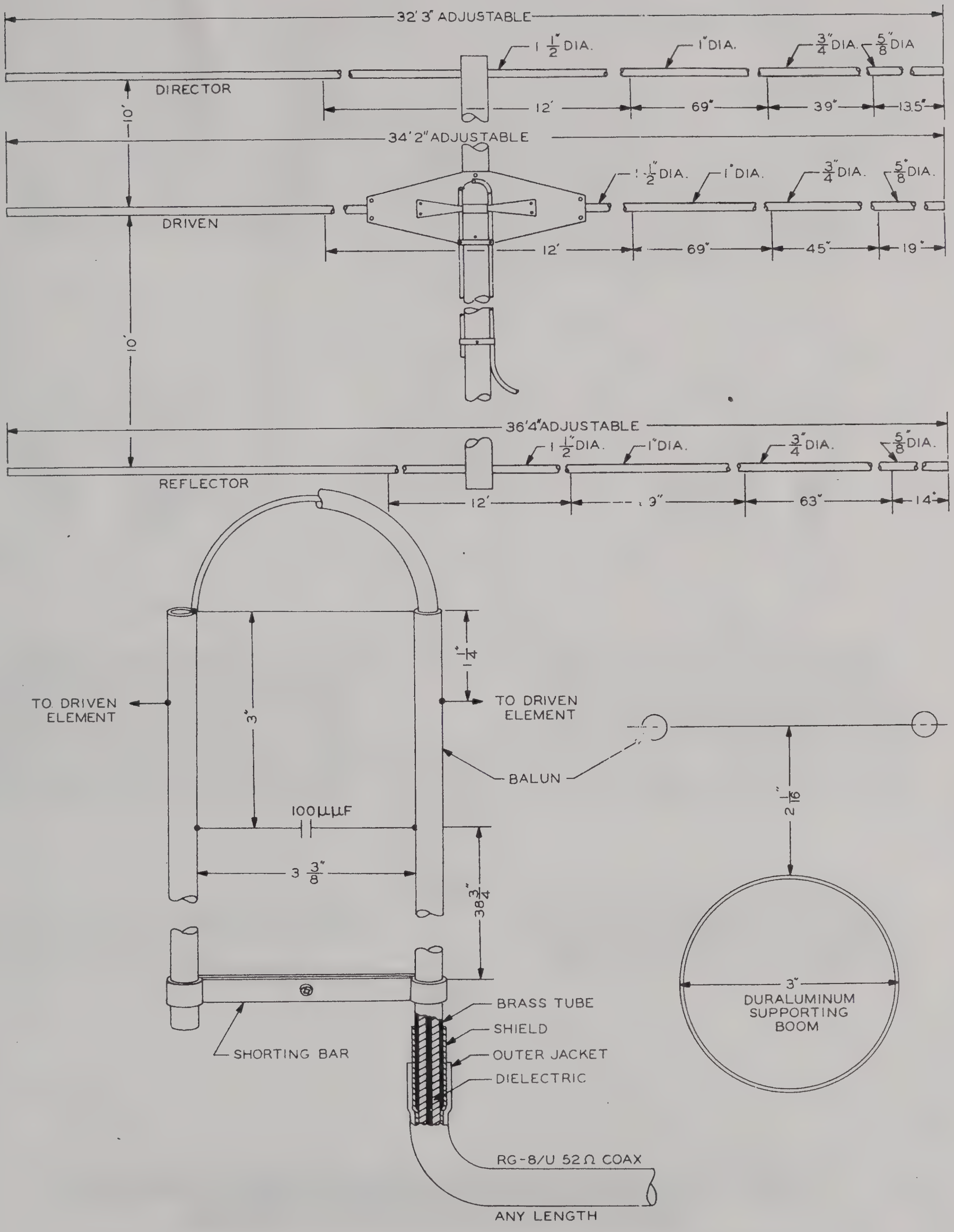
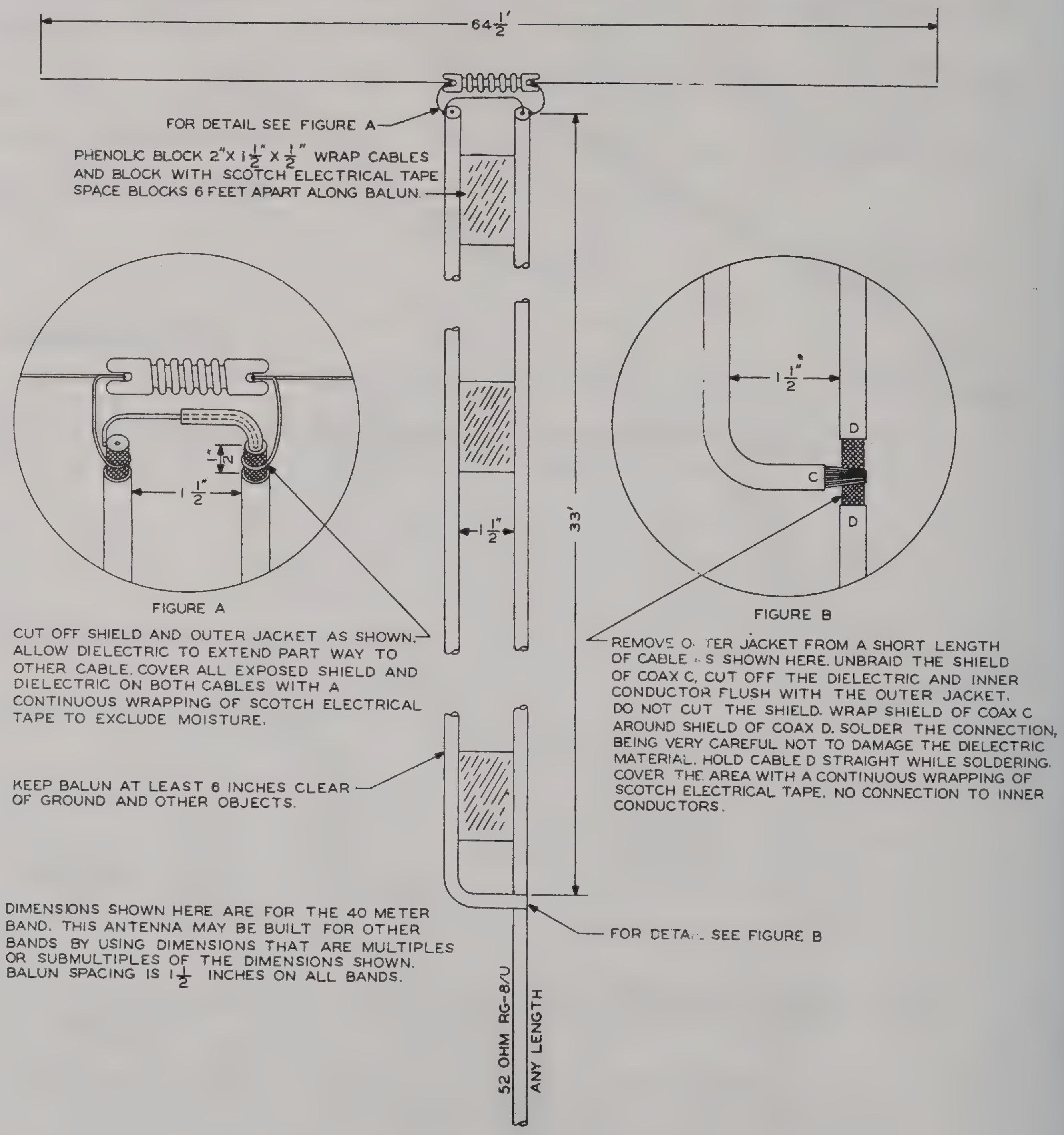


Figure 7-3 20 Meter Beam with Shortened Unbalanced to Balanced Transformer (Balun) Feed System. General Construction is the same as the Ten Meter Beam



FOR DETAIL SEE FIGURE A

PHENOLIC BLOCK 2" X 1 1/2" X 1/2" WRAP CABLES AND BLOCK WITH SCOTCH ELECTRICAL TAPE SPACE BLOCKS 6 FEET APART ALONG BALUN.

CUT OFF SHIELD AND OUTER JACKET AS SHOWN. ALLOW DIELECTRIC TO EXTEND PART WAY TO OTHER CABLE. COVER ALL EXPOSED SHIELD AND DIELECTRIC ON BOTH CABLES WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE.

REMOVE OUTER JACKET FROM A SHORT LENGTH OF CABLE [illegible] AS SHOWN HERE. UNBRAID THE SHIELD OF COAX C, CUT OFF THE DIELECTRIC AND INNER CONDUCTOR FLUSH WITH THE OUTER JACKET. DO NOT CUT THE SHIELD. WRAP SHIELD OF COAX C AROUND SHIELD OF COAX D. SOLDER THE CONNECTION, BEING VERY CAREFUL NOT TO DAMAGE THE DIELECTRIC MATERIAL. HOLD CABLE D STRAIGHT WHILE SOLDERING. COVER THE AREA WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE. NO CONNECTION TO INNER CONDUCTORS.

KEEP BALUN AT LEAST 6 INCHES CLEAR OF GROUND AND OTHER OBJECTS.

DIMENSIONS SHOWN HERE ARE FOR THE 40 METER BAND. THIS ANTENNA MAY BE BUILT FOR OTHER BANDS BY USING DIMENSIONS THAT ARE MULTIPLES OR SUBMULTIPLES OF THE DIMENSIONS SHOWN. BALUN SPACING IS 1 1/2 INCHES ON ALL BANDS.

FOR DETAIL SEE FIGURE B

Figure 7-4 Half Wave Antenna with Quarter Wave Unbalanced to Balanced Transformer (Balun) Feed System

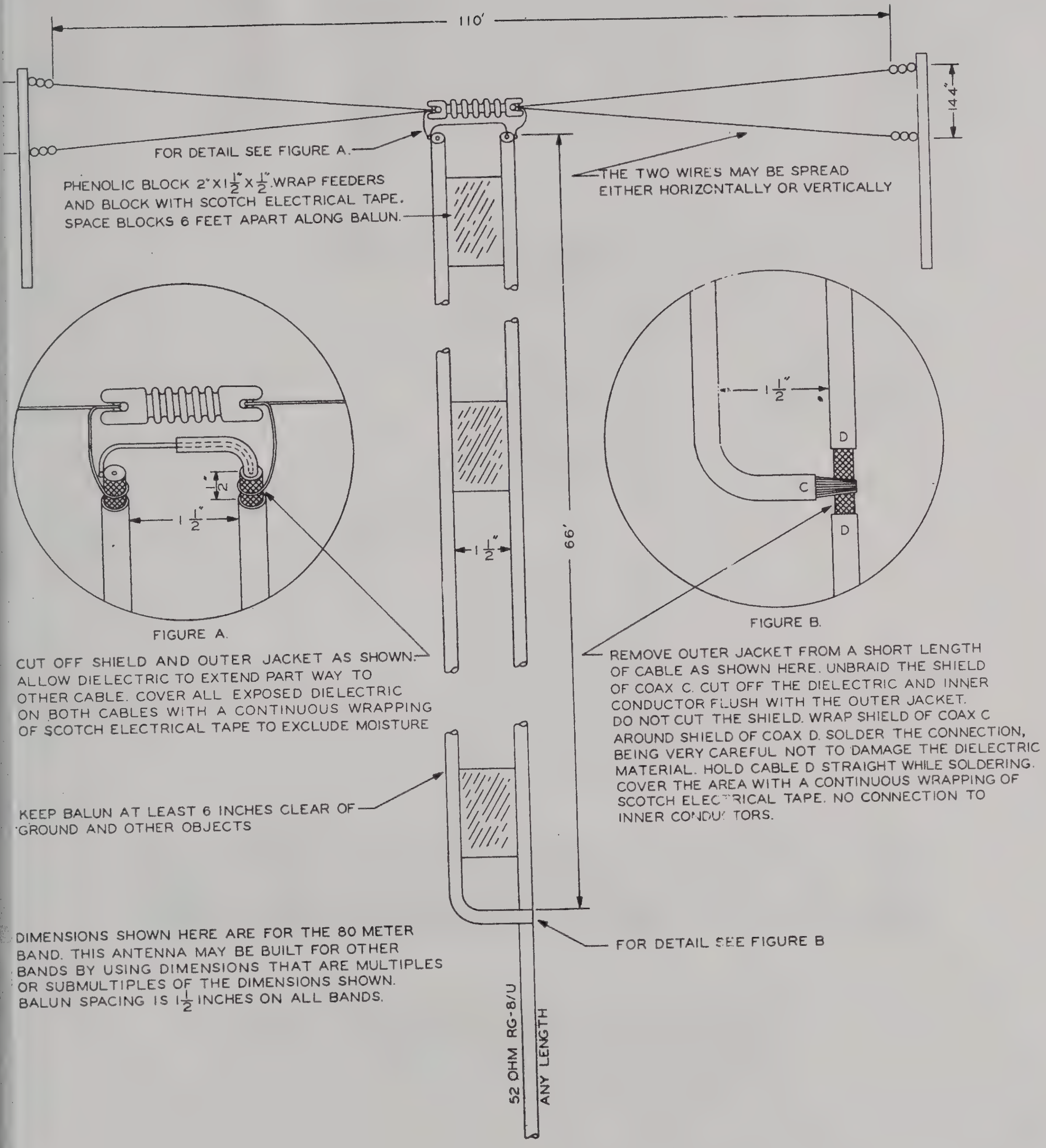

110'
14.4'
FOR DETAIL SEE FIGURE A.
PHENOLIC BLOCK 2"X1½"X½". WRAP FEEDERS AND BLOCK WITH SCOTCH ELECTRICAL TAPE. SPACE BLOCKS 6 FEET APART ALONG BALUN.
THE TWO WIRES MAY BE SPREAD EITHER HORIZONTALLY OR VERTICALLY
½"
1½"
FIGURE A.
CUT OFF SHIELD AND OUTER JACKET AS SHOWN. ALLOW DIELECTRIC TO EXTEND PART WAY TO OTHER CABLE. COVER ALL EXPOSED DIELECTRIC ON BOTH CABLES WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE TO EXCLUDE MOISTURE
1½"
66'
1½"
D
C
D
FIGURE B.
REMOVE OUTER JACKET FROM A SHORT LENGTH OF CABLE AS SHOWN HERE. UNBRAID THE SHIELD OF COAX C. CUT OFF THE DIELECTRIC AND INNER CONDUCTOR FLUSH WITH THE OUTER JACKET. DO NOT CUT THE SHIELD. WRAP SHIELD OF COAX C AROUND SHIELD OF COAX D. SOLDER THE CONNECTION, BEING VERY CAREFUL NOT TO DAMAGE THE DIELECTRIC MATERIAL. HOLD CABLE D STRAIGHT WHILE SOLDERING. COVER THE AREA WITH A CONTINUOUS WRAPPING OF SCOTCH ELECTRICAL TAPE. NO CONNECTION TO INNER CONDUCTORS.
KEEP BALUN AT LEAST 6 INCHES CLEAR OF GROUND AND OTHER OBJECTS
FOR DETAIL SEE FIGURE B
DIMENSIONS SHOWN HERE ARE FOR THE 80 METER BAND. THIS ANTENNA MAY BE BUILT FOR OTHER BANDS BY USING DIMENSIONS THAT ARE MULTIPLES OR SUBMULTIPLES OF THE DIMENSIONS SHOWN. BALUN SPACING IS 1½ INCHES ON ALL BANDS.
52 OHM RG-8/U
ANY LENGTH

Figure 7-5 Broadband Antenna With Quarter Wave Unbalanced to Balanced Transformer (Balun) Feed System

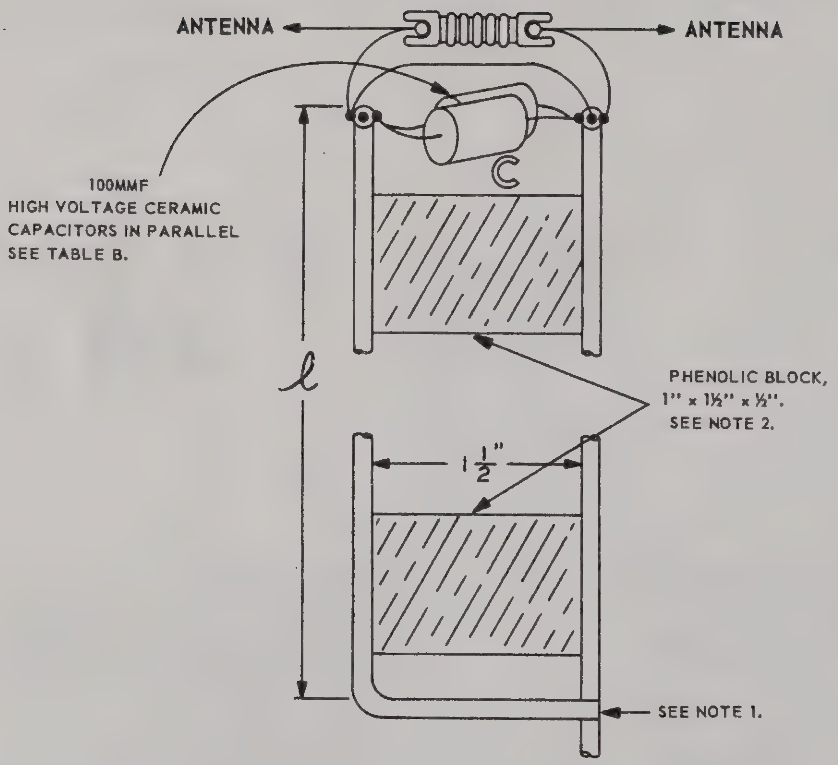


TABLE A

BAND	ℓ	C
40 METERS	7'3"	200MMF
80 METERS	13'6"	400MMF

TABLE B– SUITABLE CAPACITORS

QUANTITY	TYPE	VALUE	COLLINS PART NO.
2	CENTRALAB TYPE 850	100MMF	913 0821 00
4	CENTRALAB TYPE 850	100MMF	913 0821 00

NOTE: 1. FOR PERTINENT CONSTRUCTION DETAILS, REFER TO FIGURES ~~7-8~~ 7-4 AND ~~7-9~~ 7-5.

2. CONSTRUCT BALUN FOR 40–METER BAND WITH THREE SPACERS. CONSTRUCT BALUN FOR 80–METER BAND WITH FOUR OR FIVE SPACERS.

3. THE TWO CABLES SHOULD BE VERY NEARLY PARALLEL.

Figure 7-6 Short Balun for 40 and 80 Meters

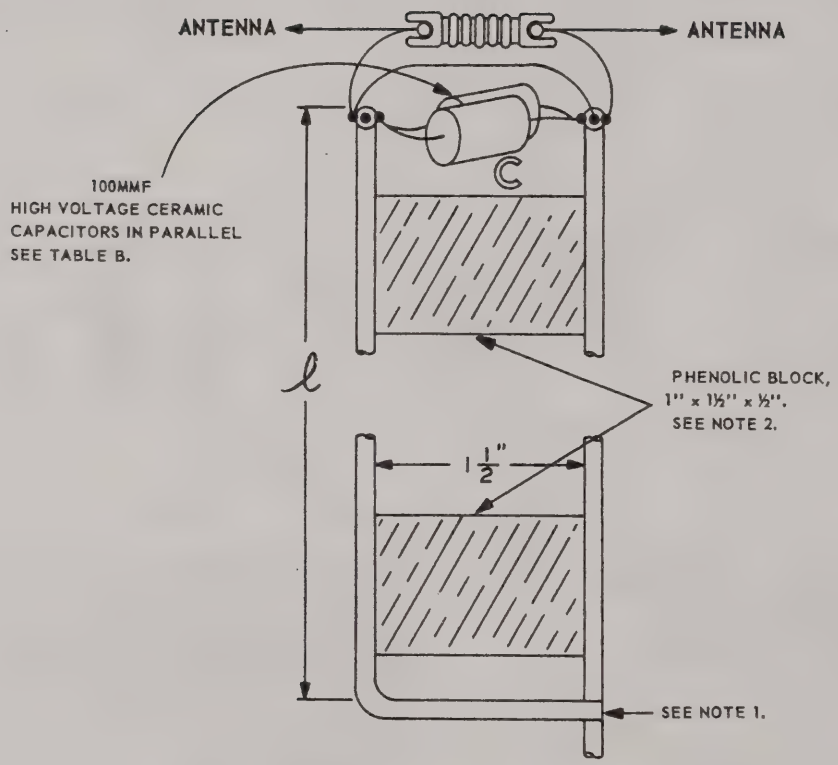


TABLE A

BAND	ℓ	C
40 METERS	7'3"	200MMF
80 METERS	13'6"	400MMF

TABLE B– SUITABLE CAPACITORS

QUANTITY	TYPE	VALUE	COLLINS PART NO.
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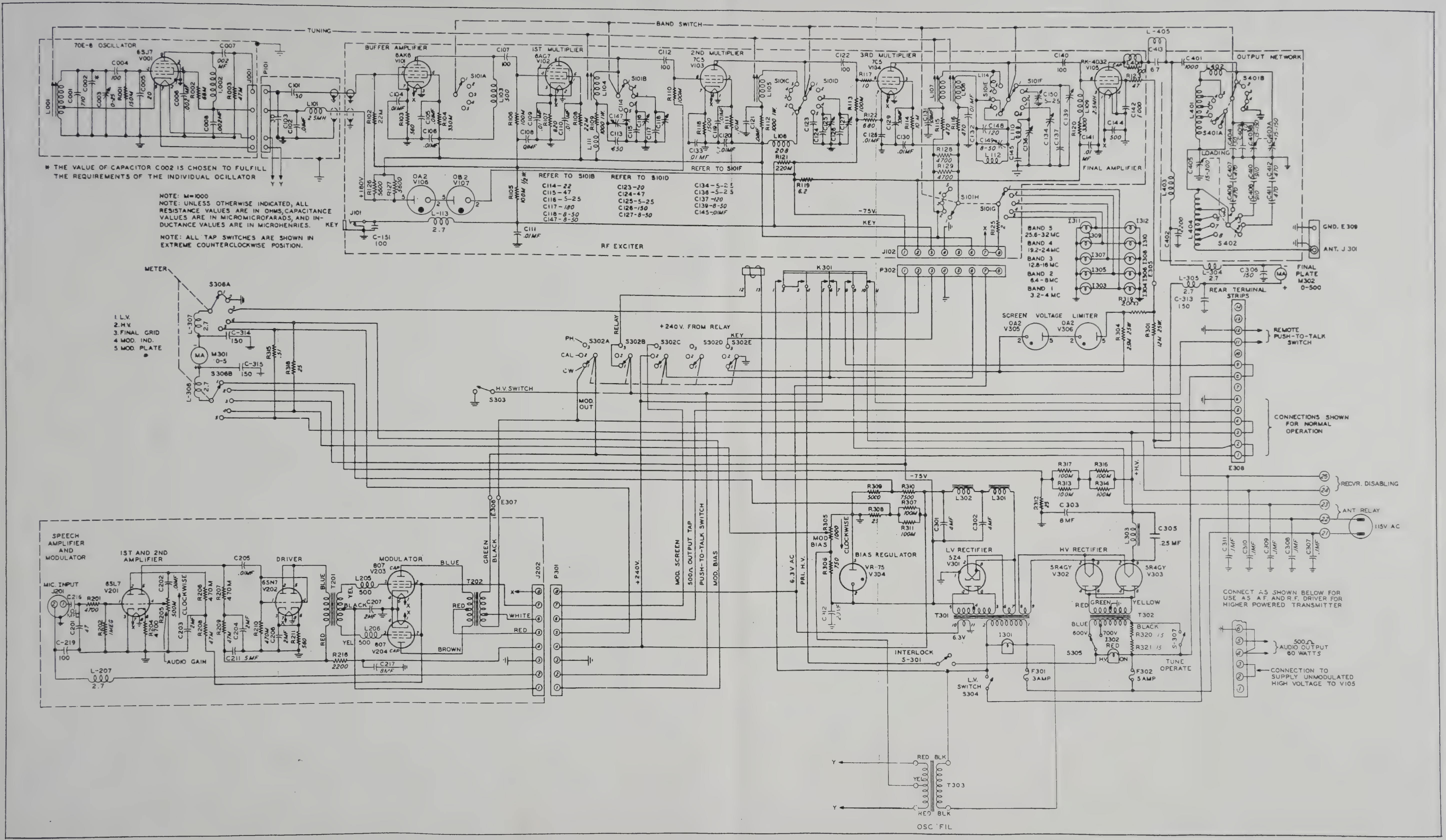
4	CENTRALAB TYPE 850	100MMF	913 0821 00

NOTE: 1. FOR PERTINENT CONSTRUCTION DETAILS, REFER TO FIGURES 7-4 ~~7-8~~ AND 7-5 ~~7-9~~.

2. CONSTRUCT BALUN FOR 40-METER BAND WITH THREE SPACERS. CONSTRUCT BALUN FOR 80-METER BAND WITH FOUR OR FIVE SPACERS.

3. THE TWO CABLES SHOULD BE VERY NEARLY PARALLEL.

Figure 7-6 Short Balun for 40 and 80 Meters



* THE VALUE OF CAPACITOR C002 IS CHOSEN TO FULFILL THE REQUIREMENTS OF THE INDIVIDUAL OCILLATOR

NOTE: M=1000

NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRIES.

NOTE: ALL TAP SWITCHES ARE SHOWN IN EXTREME COUNTERCLOCKWISE POSITION.

CONNECT AS SHOWN BELOW FOR USE AS A.F. AND R.F. DRIVER FOR HIGHER POWERED TRANSMITTER

500Ω AUDIO OUTPUT 60 WATTS

CONNECTION TO SUPPLY UNMODULATED HIGH VOLTAGE TO V105

Figure 5-10 Model 32V-3 Complete Schematic Diagram

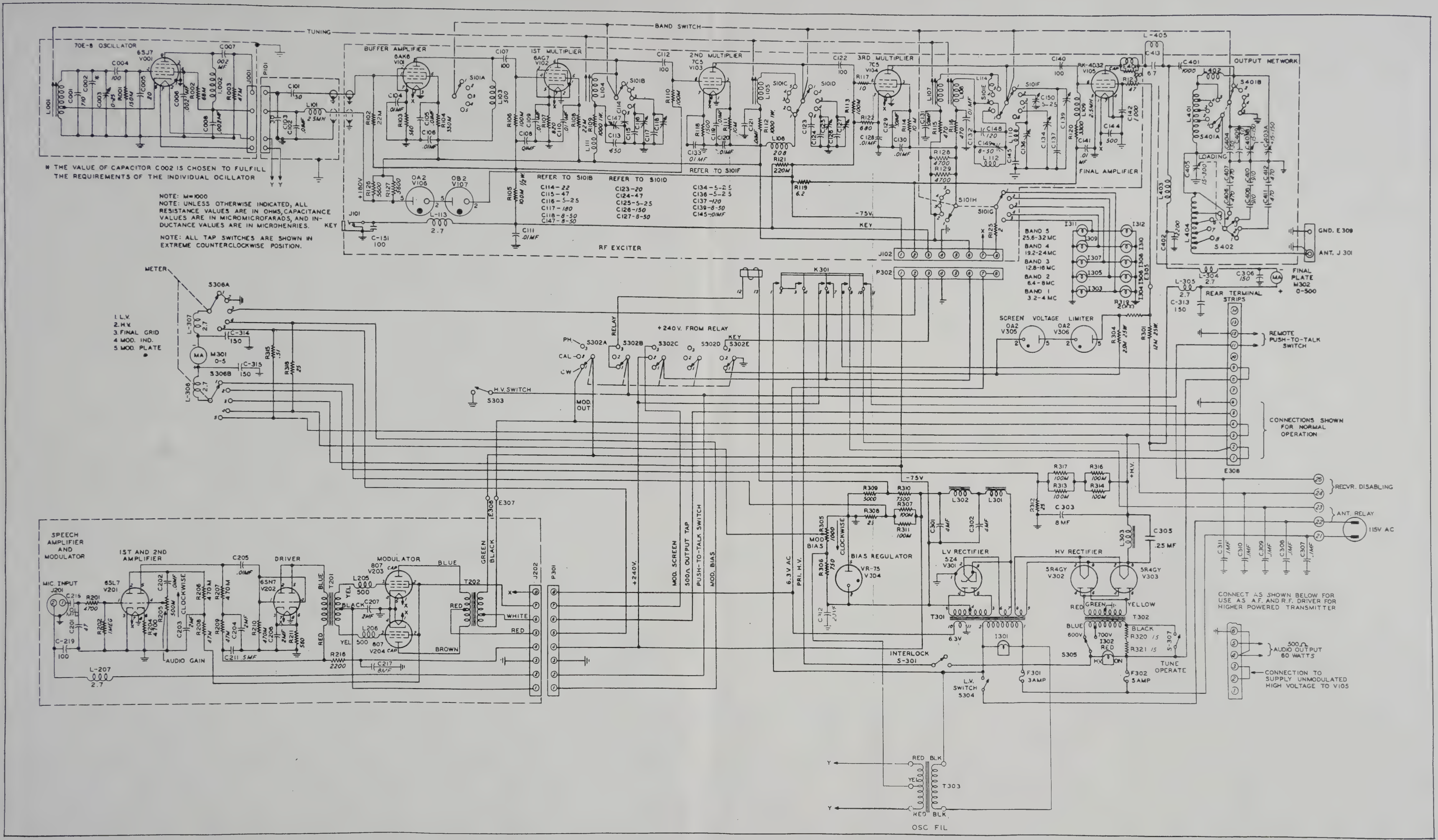


Figure 5-10 Model 32V-3 Complete Schematic Diagram

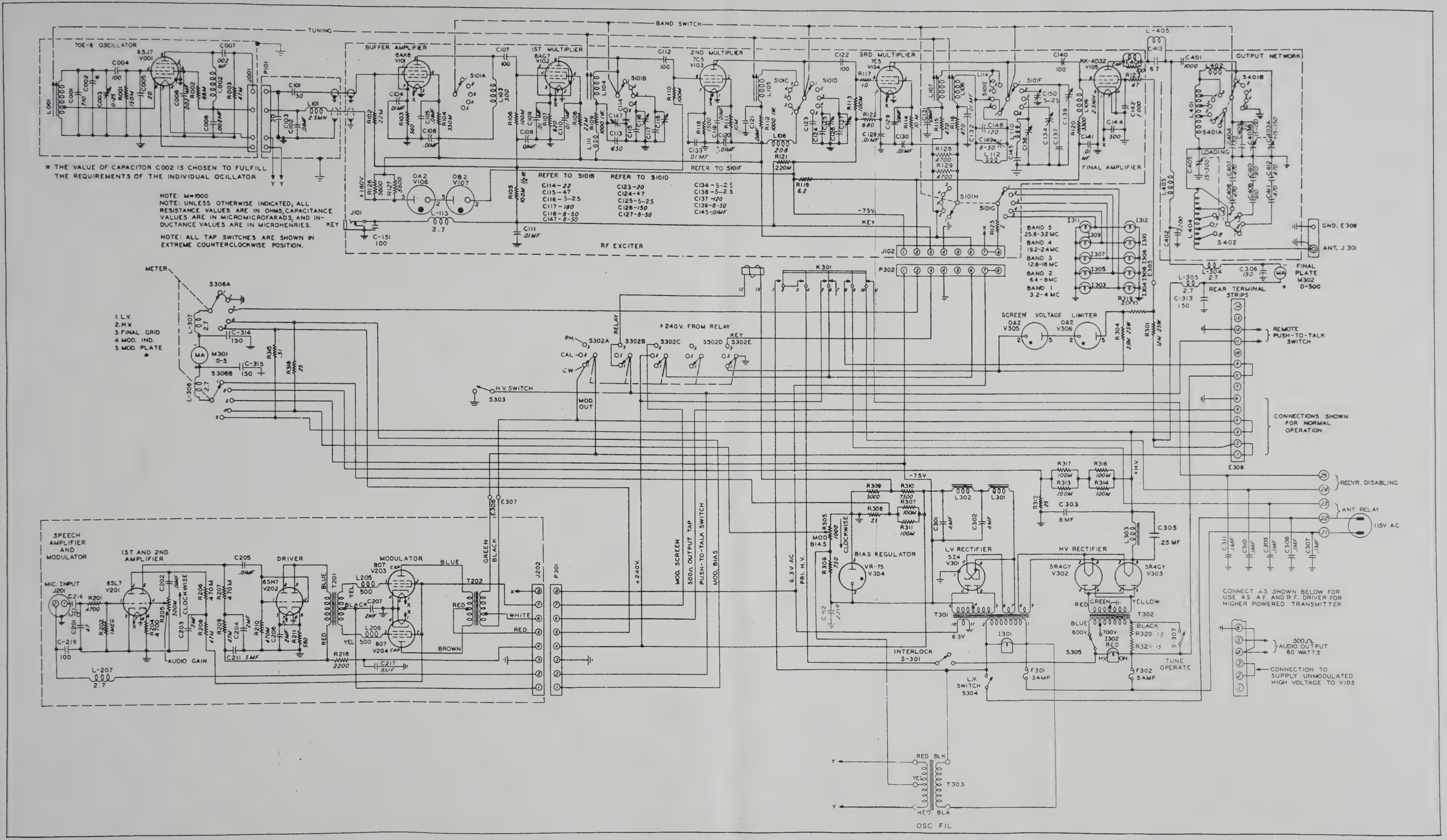
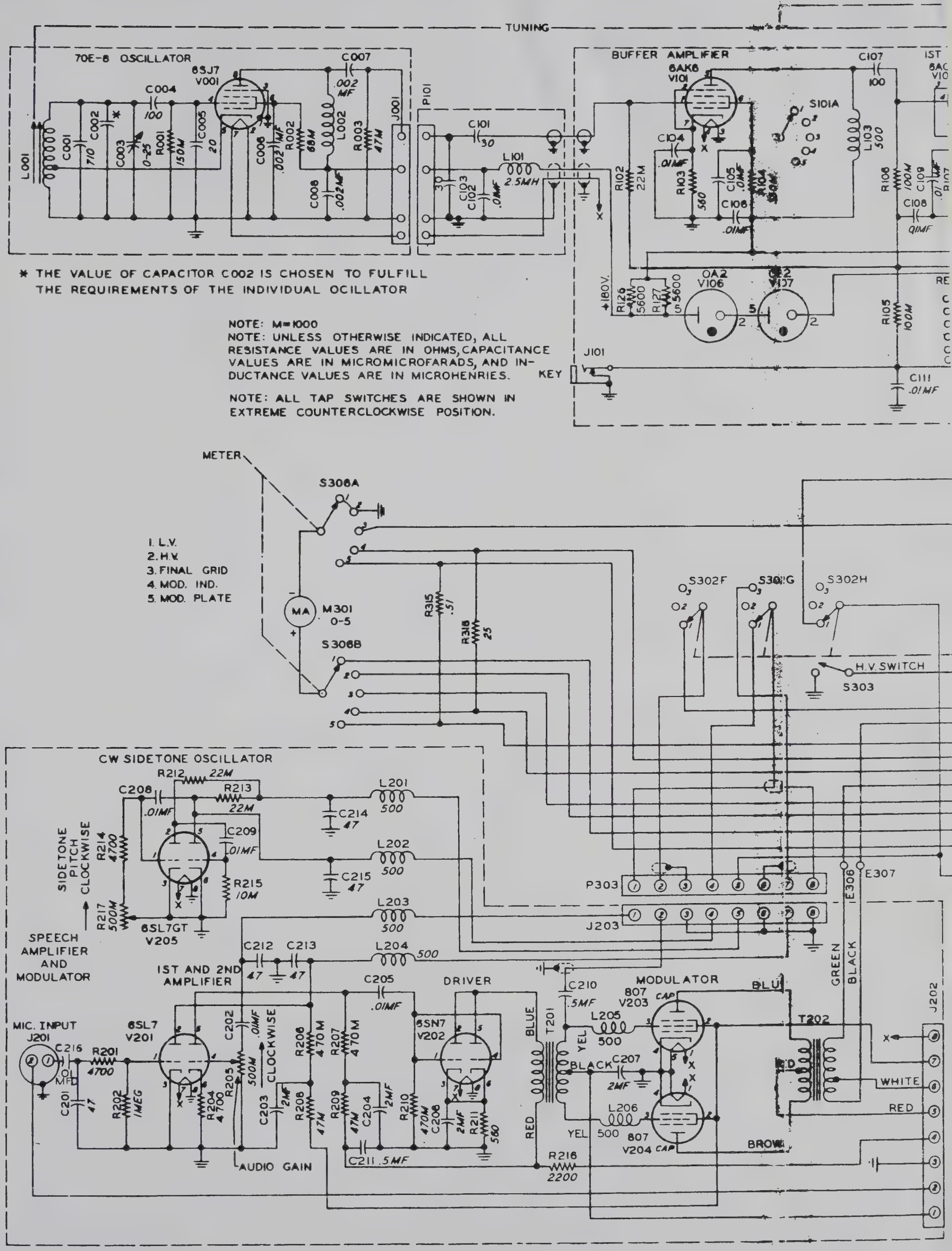


Figure 5-10 Model 32V-3 Complete Schematic Diagram

MAKe

4 more

Schematics



* THE VALUE OF CAPACITOR C002 IS CHOSEN TO FULFILL THE REQUIREMENTS OF THE INDIVIDUAL OSCILLATOR

NOTE: M=1000

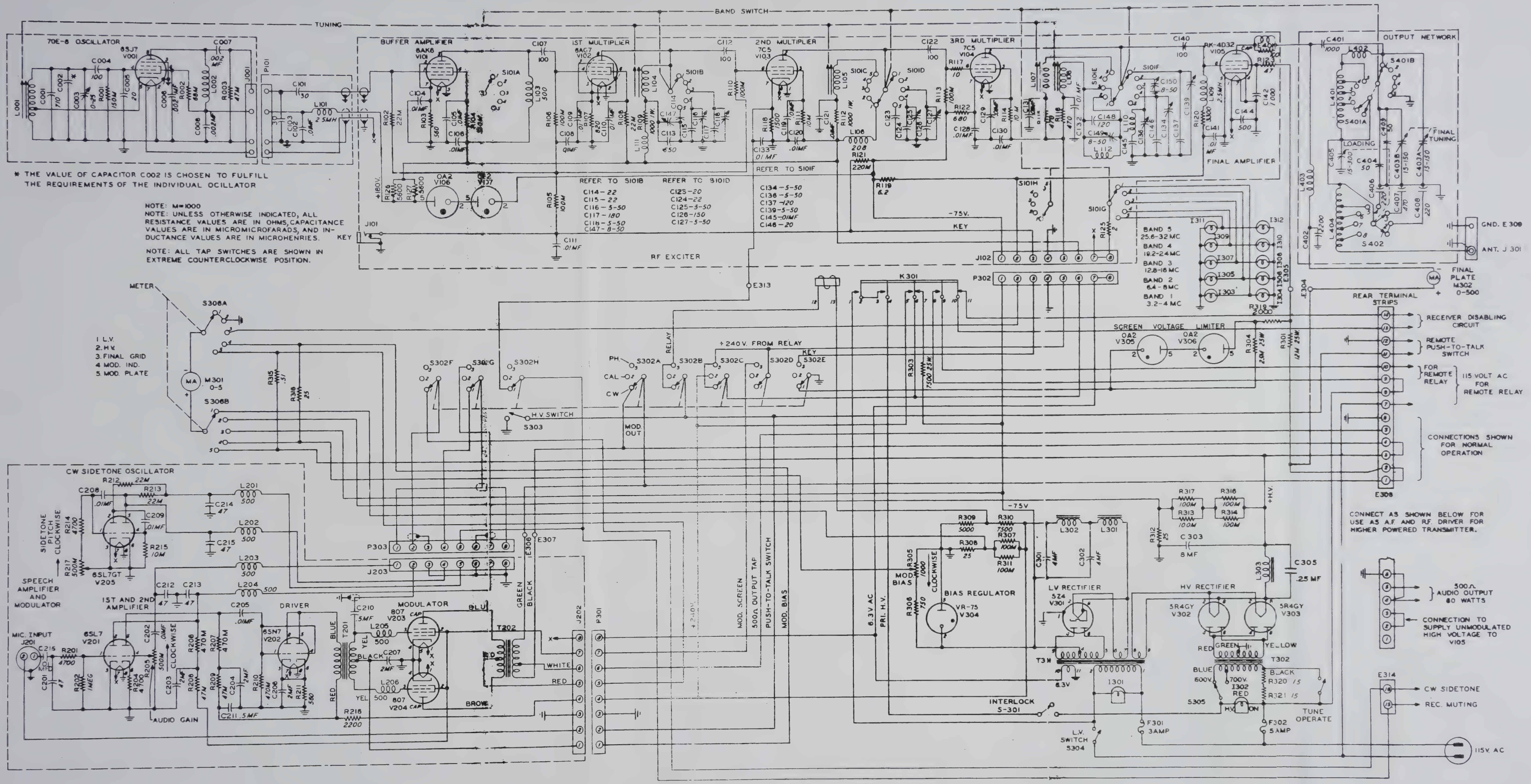
NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRIES.

NOTE: ALL TAP SWITCHES ARE SHOWN IN EXTREME COUNTERCLOCKWISE POSITION.

MAKE

4 more

Schematics



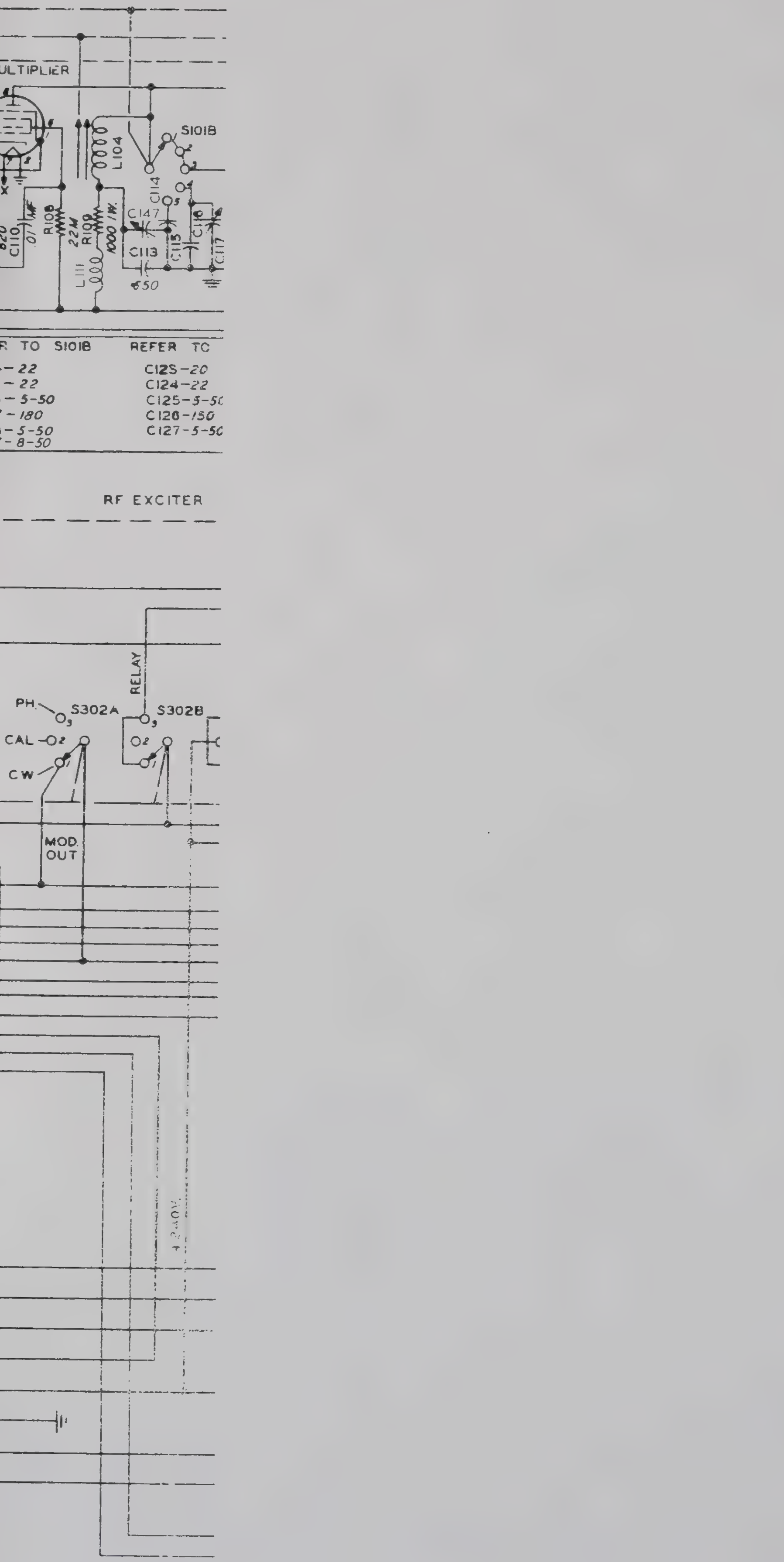
* THE VALUE OF CAPACITOR C002 IS CHOSEN TO FULFILL THE REQUIREMENTS OF THE INDIVIDUAL OCILLATOR

NOTE: M=1000
NOTE: UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRIES.

NOTE: ALL TAP SWITCHES ARE SHOWN IN EXTREME COUNTERCLOCKWISE POSITION.

CONNECT AS SHOWN BELOW FOR USE AS A.F. AND R.F. DRIVER FOR HIGHER POWERED TRANSMITTER.

Figure 5-8 Model 32V-2 Complete Schematic Diagram


ULTIPLIER
S101B
L104
C114
C147
R108
22 K
R109
1000 1W.
C110
.01 MF
820
L111
C113
C115
C116
C117
650
R TO S101B
- 22
- 22
- 5-50
- 180
- 5-50
- 8-50
REFER TO
C123-20
C124-22
C125-5-50
C126-150
C127-5-50
RF EXCITER
RELAY
PH.
S302A
S302B
CAL
CW
MOD. OUT
+240V.

COLLINS

32V-2
AMATEUR TRANSMITTER

INSTRUCTION BOOK

COLLINS RADIO COMPANY

32V-2 ADDENDA

February 1, 1950

After recognizing the high order of filtering that it was necessary to incorporate in an amateur transmitter operating in close proximity to television receivers, Collins engineers designed an output network to be used in the 32V-2 which should offer a great deal of attenuation to high order harmonics. In order to do this, it was necessary that an additional "L" section filter be added to the existing pi section. This new section contributes a great deal of filter action, but also offers some disadvantages. The first apparent difficulty noted is the apparent sharpness of tuning on the high frequency bands, particularly 28 mc. It must be recognized that this is inherent in any tuned filter where a high degree of selectivity is needed, and the fact that it does tune so sharply indicates that it is operating properly. Since the impedance across the L section inductance reaches fairly high values so does the voltage, and in certain cases, the addition of modulation to the carrier causes the output capacitor to arc across. It has been found that this voltage can be decreased to a point where this no longer occurs by lowering the inductance of the 28 mc portion of the L section inductor. The decrease in filter action by such a move is slight.

This modification, which is included in the 32V-2's (after serial #1325), is fortunately a simple one and can be readily accomplished by the customer. The task is to change the uppermost tap on L404 so that the inductance will consist of 8 turns from the top end of the coil instead of 11. An examination of this inductance will readily show that it is a simple task to move the lead that goes to the 11th turn from the top to the 8th.

Another source of difficulty that is occasionally encountered is the failure of the fixed ceramic loading capacitors in the pi section network. Unfortunately, the solution of this problem is not so simple and requires an understanding by the customer of the variables involved.

The pi section network was designed so that when used with the L section, a suitable range of impedances could be satisfactorily matched. The extreme cases were tabulated and the resulting voltages and currents were calculated. These voltages and currents were of such a magnitude as to not exceed the ratings of the components. However, when the customer connects the 32V-2 to an antenna system, frequently the standing waves are of such a nature as to reflect sufficient reactance so that the assigned endpoints of impedances are exceeded. This frequently results in an excess current thru the loading capacitors and subsequent failure.

However, when adequate precautions are taken, this problem can be greatly reduced. These precautions may be described simply by stating that they are directed in such a manner as to insure a flat 52 or 72 ohm line from the 32V-2 to the antenna tuner. The tuning procedure is as follows.

Disconnect the coaxial line from the antenna tuner link and terminate it in a non-inductive resistor whose value is the same as the Z_o of the coaxial line, and whose power rating is sufficient to dissipate 50 watts or so for prolonged periods. The transmitter should then be tuned and loaded to the proper point in the "tune" position. The unit should then be momentarily switched to the operate position to see that the final plate current reading is correct. In the event that non-inductive resistors are not available, it is possible to use a 100 watt lamp and obtain a SWR of about 1.5/1 on a 52 ohm line.

The coaxial line should then be connected through a series variable capacitor to the antenna tuner link of one turn on 10, 15 and 20 meters, two turns on 40 meters and three on 80 meters. The antenna tuner is resonated with the transmitter and the link reactance tuned out with the coaxial line series capacitor. The feeders should then be moved in equal increments out from the center, with the tuned circuit resonated, until the same loading condition exists that was noted with the dummy load. This will set up the desired condition where the transformation of impedance from the coaxial line is from 52 or 72 ohms to the antenna impedance. If this is done no standing waves will exist on the coaxial line and the loading capacitors will not be operated at excessively high values of current.

32V-2

AMATEUR TRANSMITTER

Manufactured by

COLLINS RADIO CO., CEDAR RAPIDS, IOWA

520 9465 00

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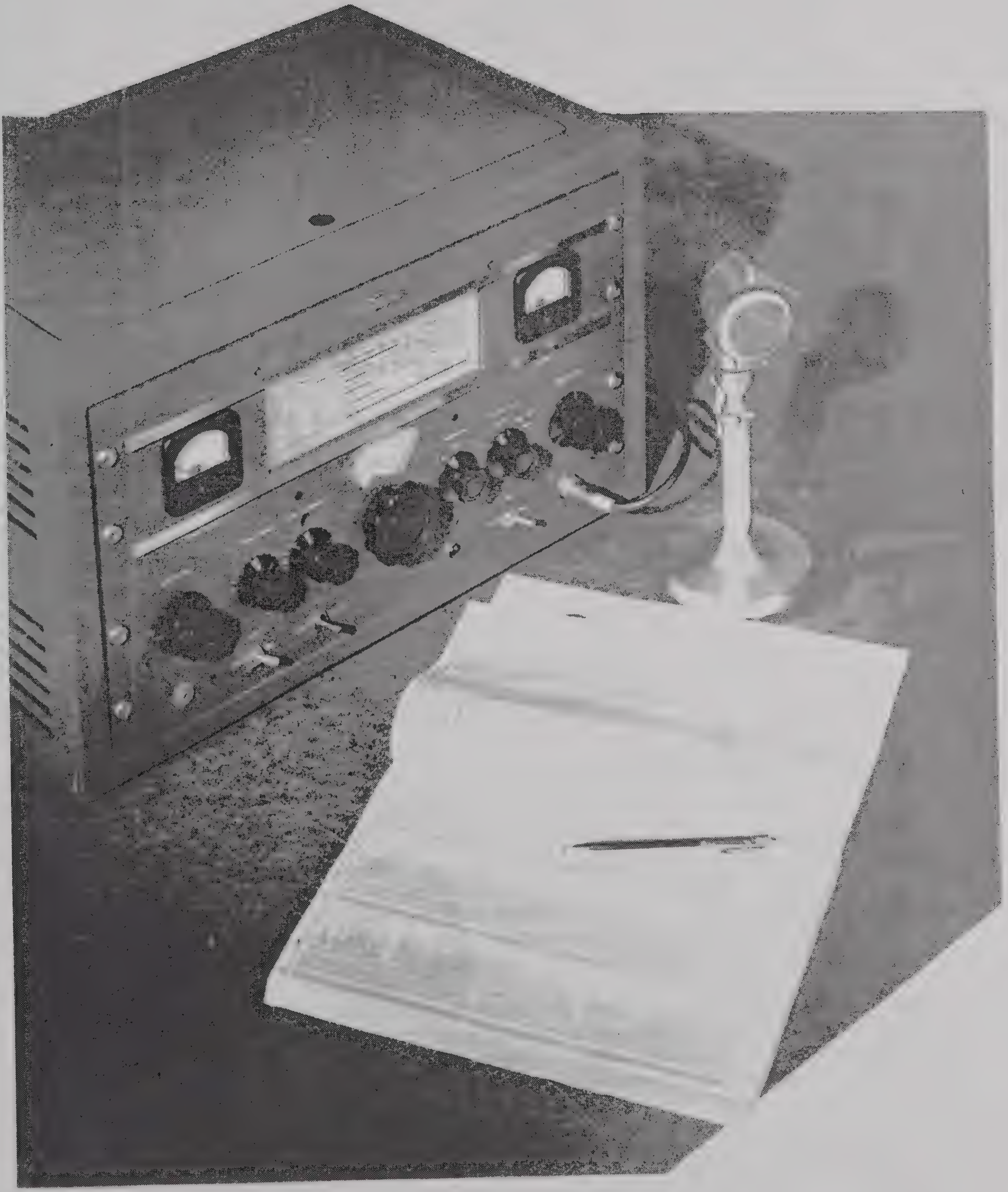


FIGURE 1-1 MODEL 32V AMATEUR TRANSMITTER

SECTION 1

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. This instruction book has been prepared to assist in the proper installation, adjustment, operation and maintentenance of the Collins 32V-2 amateur transmitter.

The type 32V-2 is a transmitter designed for those amateurs who want medium power, bandswitching, and VFO control in a small cabinet. It may be used for either permanent or portable installations. All that is needed for putting it into operation is a 115 volt ac source, an antenna, and a key or microphone. The 32V-2 can also be used to drive a kilowatt final amplifier.

The 32V-2 transmitter is designed for table mounting. The complete transmitter is housed in a single cabinet 21-1/8" wide, 12-7/16" high and 13-7/8" deep and weighs approximately 105 lbs. Ventilating openings are provided in the back,two sides and bottom of the cabinet to assure adequate ventilation for all heat producing elements.

The components of the transmitter are so arranged that unit construction is possible and are broken down in five units as follows:

70E-8A Oscillator
R-F Unit
Output Network
Speech Amplifier and Modulator
Power Supply

All wiring is independent of the cabinet, and the complete unit may be removed from the cabinet for inspection or maintenance.

Complete coverage of the 80, 40, 20, 15, 11 and 10 meter bands is obtained with the 32V-2. Quick band-change is accomplished by bandswitching on all stages. The permeability tuned circuits of the 1st, 2nd and 3rd multipliers have their tuning controls ganged with the oscillator. The final tank consists of impedance matching network with two separate controls located on the front panel, one for tuning and one for loading.

Two heavy duty toggle switches control the low voltage and high voltage circuits. The switches are arranged so that the high voltage cannot be applied until the low voltage circuits have been energized. A push-to-talk switch, associated with the microphone, may be used to apply the high voltage instead of the HV toggle switch for added convenience.

A CW sidetone oscillator is incorporated in this unit with which CW transmissions can be monitored.

An additional feature, the receiver muting connection, can be used to silence a type 75A receiver during CW transmission for CW break-in operation.

A meter selector switch on the front panel enables the operator to meter all important circuits of the transmitter. This switch can be rotated to five different positions. Each position inserts a meter into the selected circuit to be metered. A separate meter reads FINAL AMPLIFIER plate current only. The CW-CAL-PH switch is used to select the type of emission desired and to calibrate the accuracy of the dial reading against a known standard frequency. In the CW position, the modulator is disabled, the master oscillator operates continuously with the HV switch on and the CW sidetone oscillator is connected to the audio amplifier stages. On "CAL" position a signal of strength suitable for zero-beating with incoming signals may be heard in the associated receiver without operating the final amplifier. On phone position, the key is closed and the modulator is operative. Keying is accomplished by means of grid block keying of the buffer stages. This keying is done on the buffer and first and second multiplier stages.

The AUDIO GAIN Control is used to control the level of modulation and the strength of CW sidetone output.

1.2. REFERENCE DATA.

Power Source: 115 volts ac 50/60 cps single phase.

Power Input Requirements: The maximum overall input power requirement is 500 watts at 90% power factor.

PA Plate Power Input: The nominal rated power input of the 32V-2 is 120 watts on phone and 150 watts CW.

Audio Distortion: Audio distortion is less than 8% at 90% modulation with a 1000 cps input frequency.

Frequency Response: Within 2 db from 200-3000 cps.

1.3. TUBE COMPLEMENT.

Quantity	Tube Type	Function
1	6SJ7	Oscillator
1	6AK6	Buffer Amplifier
1	6AG7	First Multiplier
1	7C5	Second Multiplier
1	7C5	Third Multiplier
1	4D32	RF Power Amplifier
1	6SL7	Audio Amplifier
1	6SN7	Audio Driver
2	807	Modulators
1	5Z4	LV Rectifier
2	5R4GY	HV Rectifier
1	VR-75	Bias Regulator
1	6SL7GT	CW Sidetone Oscillator
2	OA2	Screen voltage limiters

SECTION 2

INSTALLATION

2.1. UNPACKING.

After the unit has been removed from the packing box, inspect the unit for loose screws or bolts. Be certain all controls, such as switches, dials, etc. work properly. In case of damage, file all claims promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved. Check all tubes to see that they are fully in their sockets. See figure 2-1 for tube placement.

2.2. PLACING TRANSMITTER.

The console type cabinet is designed to be placed on the operating table along with the receiving equipment. Allow enough space at the rear for making the necessary external connections and for replacement of fuses. Sufficient clearance at the sides should be provided for full circulation of air.

2.3. EXTERNAL CONNECTIONS.

Place the two power switches in the off position before attempting to make any external connections. The external connections are as follows:

(1) AC Power Line
(2) Microphone and Key
(3) Radiation System
(4) Remote Relay
(5) Receiver Disabling Circuit
(6) CW Sidetone
(7) Receiver Muting

2.3.1. POWER LINE. - The 32V-2 operates from a 115 volt, single phase, 50/60 cycle power source. The supply line should be checked for these specifications. The maximum power required from the line is 500 watts. Insert the 115 volt plug into a convenient standard outlet.

2.3.2. MICROPHONE AND KEY. - The microphone plug is inserted in the microphone jack J201 on the front of the transmitter. Make sure the clamping ring on the microphone plug is tightly turned on the thread around the input receptacle. Push-to-talk control connections are made to pin number 2 to ground in the microphone plug where the microphone being used is equipped with a push-to-talk switch. When using a microphone that does not have such a switch, the transmitter can still be controlled from a remote position by running a pair of leads from terminal 11 and 12 on the rear terminal strip (E308) to a switch box located at some point convenient to the operator.

CAUTION

Do not get the microphone and push-to-talk connections reversed when assembling the microphone plug since the relay voltage present could damage certain types of microphones.

The telegraph key is plugged into the key jack, J101, on the front panel.

2.3.3. RECEIVER DISABLING CIRCUIT. - Terminals 13 and 14 on the rear terminal strip (E308) are connected to normally closed contacts on the carrier control relay and are to be used for connections to the receiver disabling circuit. Remove the jumper on the receiver terminals and connect terminals 13 and 14 to these two terminals. The receiver can then be made inoperative when the push-to-talk switch is pressed or whenever the HV switch is operated.

2.3.4. REMOTE RELAY CONNECTIONS. - Terminals 7,8,9 and 10 on the rear terminal strip may be used for operating an antenna change-over relay or a relay for turning on the plate power of a power amplifier stage when the 32V-2 is used as an exciter. If a 115 volt ac type relay is used, connect the leads from the relay coil to terminals 7 and 10. In this manner, the relay coil will be energized thru contacts 8 and 9 of relay K301 whenever the push-to-talk switch or HV switch is operated. If a dc type of relay is used, remove the jumper from terminals 8 and 9 and use terminals 9 and 10 to control the operations of the remote relay thru the contacts of the transmitter relay.

CAUTION.- Do not use the RECEIVER DISABLING CIRCUIT AND REMOTE RELAY CONNECTIONS for conducting large currents, as damage to the relay contacts may result.

CAUTION. - For safety reasons, remove the 115 volt plug from the AC power outlet while making connections to the rear terminal strip.

Switch pi S101H, located at the rear of the band switch, can be used to automatically operate antenna selector relays, etc., as the band switch is turned. Connections to this switch section will have to enter the cabinet through a ventilation slot at the side of the cabinet.

2.3.5 CW SIDETONE. - Any 500 ohm or higher impedance headphone or 500 to 1000 ohm speaker can be connected between terminals 16 and 12 (gnd) at the rear of the unit for sidetone output. The sidetone will be operative when the EMISSION switch is in the CW position. Sidetone pitch is controlled from within the top door while the volume is controlled by the AUDIO GAIN control.

2.3.6. RECEIVER MUTING. - If a Collins Model 75A receiver is used for receiving, CW break-in operation can be improved by connecting terminal B on the receiver to terminal 15 on the 32V and terminal G to terminal 12 (gnd). This connection mutes the receiver audio when the key is pressed and the receiver NOISE LIMITER switch is in the IN position. For CALIBRATION, the receiver limiter switch should be in the OUT position.

2.3.7. RADIATION SYSTEM.-The output network will match impedcance of 26 to 300 ohms on all bands. It will tune out inductive or capacitive reactances normally encountered. The output network is unbalanced with respect to ground and may be used to feed directly into unbalanced systems. Connection to the antenna transmission line is made by means of a PL-259 52 ohm coaxial connector. Do not end feed antennas which are multiples of 1/2 wave in length directly from the antenna terminals; rather, use an external antenna tuner. Random length antennas must not fall on exact odd multiples of 1/4 wave-length long but should be 10 to 20% longer or shorter. A Type 315E-1 Balun Transformer (not supplied) may be used to feed a balanced antenna system.

2.3.8.. EXTERNAL ANTENNA TUNE. (Not Available)

To feed balanced transmission lines, tuned or untuned, couple the transmitter to the transmission line with a simple tuned circuit illustrated below.

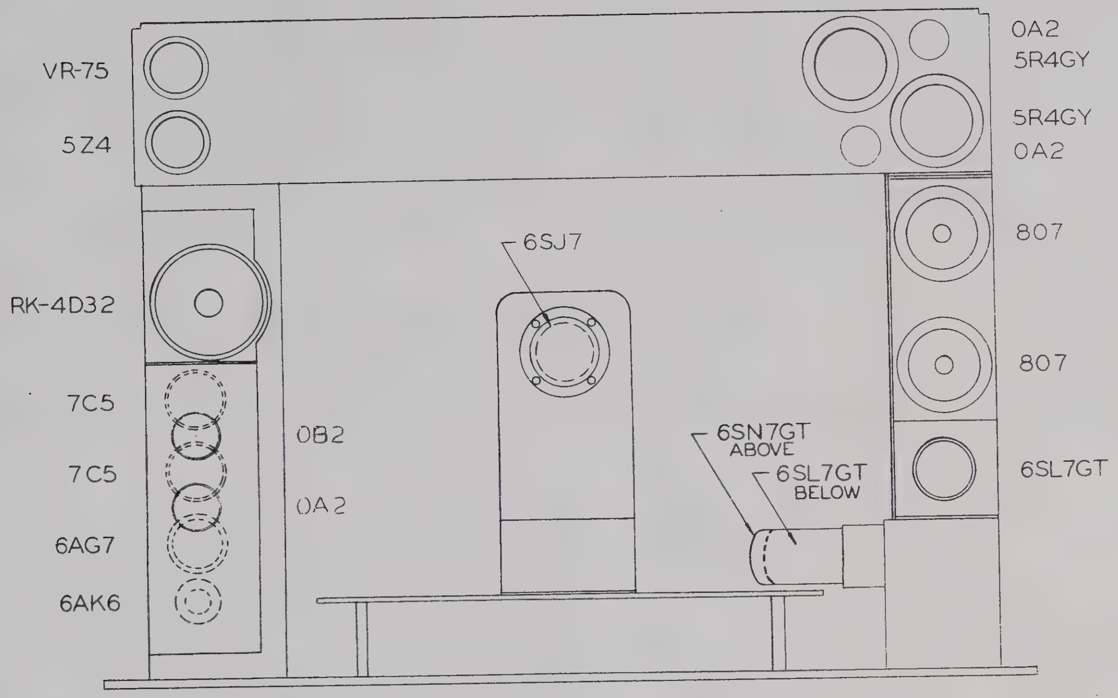
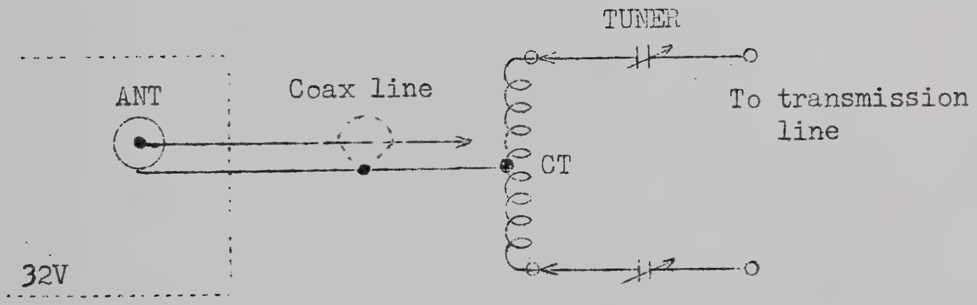
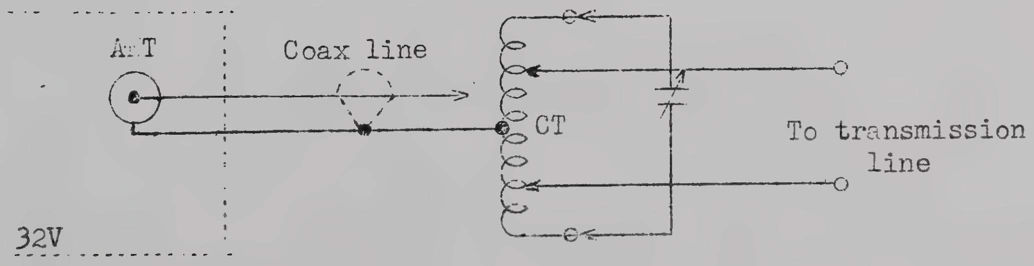


Figure 2-1 Tube Placement Diagram



SERIES TUNING



PARALLEL TUNING

Figure 2-2 Typical Antenna Tuner

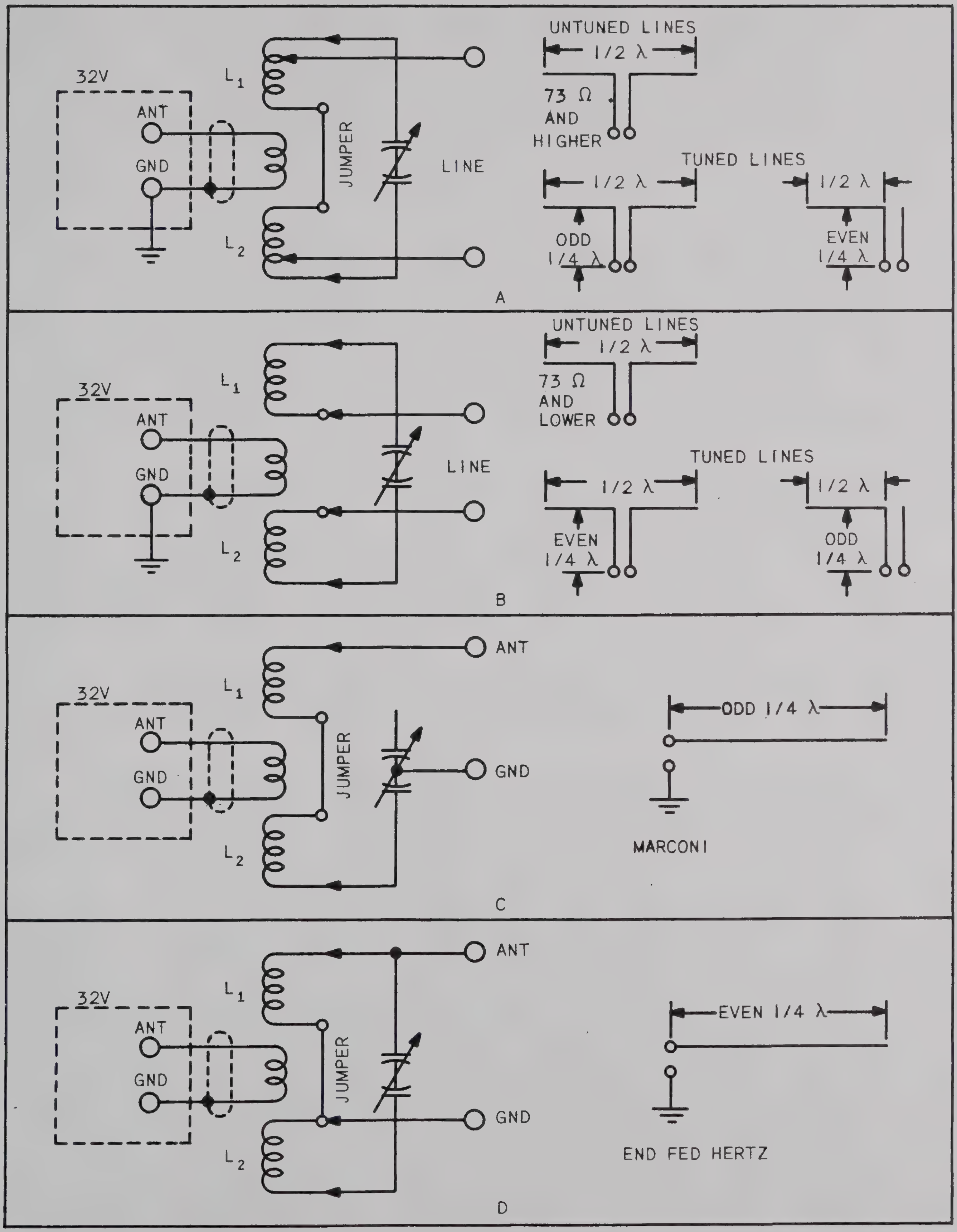


Figure 2-3 Typical Antenna Tuner Circuits

This arrangement will match a wide range of impedances. It will also add further attenuation to harmonics causing TVI, providing it is completely shielded. Figure 2-2 illustrates an antenna tuner which will function satisfactorily in this application. The impedance of the transmission line is matched by choosing proper taps on the inductances L1 and L2. The coupling link is coupled as tightly as possible and all loading adjustments are done with the LOADING control on the 32V-2. On the 15, 11, and 10 meter bands, the number of turns in the coupling coil should not exceed one turn; two turns may be necessary on the 20 meter band.

a. UNTUNED HIGH IMPEDANCE TRANSMISSION LINE. - If the line has a characteristic impedance of 73 ohms or more, parallel tuning of the antenna coils L1 and L2 should be employed. For parallel tuning, the little jumper seen above the antenna coils should be closed. The transmission line taps should be set on the same turns as the capacitor taps to start with, then varied towards the center of the coils until proper loading is obtained. The transmission line taps are those at the top of the coils while the capacitor taps are those nearer the bottom. In this type of operation, low values of capacitance and high values of inductance for the operating frequency generally are best. See illustration A., figure 2-3.

b. UNTUNED LOW IMPEDANCE TRANSMISSION LINES. - Transmission lines having a characteristic impedance of less than 50 ohms require series tuning of the antenna coils. This is done by opening the small jumper above the coils and moving the transmission line tap arms to the inside coil turns. The capacitor taps should be set at the outside turns and varies towards the inside turns until proper loading is obtained. Higher values of tuning capacity usually work out best in this type of operation. See illustration B., figure 2-3.

c. VOLTAGE FED TUNED LINES. - Transmission lines which have a high voltage point at the transmitter should be connected and tuned identically with instructions given in a. above. It is recommended that tuned lines be cut to multiples of a quarter wave in length.

d. CURRENT FED TUNED LINES. - Transmission lines having high current at the transmitter end should be connected and tuned identically with instructions given in b. above. These lines should also be cut to exact multiples of a quarter wave in length.

e. QUARTER WAVE MARCONI. - Series tuning is indicated for quarter wave Marconi antennas, In this type of operation, the antenna tuning circuit should be connected so that the two sections of the antenna coil and one half of the antenna tuning capacitor are in series. To do this, place a grounding jumper to the rotor of the antenna tuning capacitor, connect the antenna to one end of the antenna coil, connect one stator of the tuning capacitor to the other end of the antenna coil and disconnect the other stator completely. (Place a piece of insulation material between the tap rotor and the coil turns.) See illustration C., figure 2-3. In event r-f voltage appears on the cabinet, it can be minimized by extending the ground wire to 1/2 wave length and series tuning it until resonance is obtained.

f. END FED HALF WAVE. - This tuner can be used to tune this type of antenna also. Parallel tuning should be employed for this type operation. The antenna should be connected to one end of the antenna coil, a ground connection should be made to the inside turn of one of the antenna coils and the little jumper on top of the coils should be closed. The tuning capacitor taps should be equally spaced from each end of the antenna coils for proper tuning at the operating frequency. See illustration D., figure 2-3.

SECTION 3

ADJUSTMENT AND OPERATION

3.1. ADJUSTMENT.

3.1.1. 600 v - 700 v SWITCH. - This switch, located in the primary of the power transformer, has been placed at the rear of the transmitter to select output voltages of either 600 or 700 volts. It is recommended that this switch be placed in the 600 volt position for initial adjustments.

3.1.2. CALIBRATION. - To check dial calibration, proceed as follows:

(a) Turn the equipment ON as outlined in steps (a) and (b) paragraph 3.2.3.

(b) Tune a communications receiver to WWV at 10 mc. The BFO in the receiver should be OFF.

(c) Rotate the BAND switch to 80 meter band. (lowest scale)

(d) Rotate the TUNING dial to 4.0 mc.

(e) Rotate the CW-CAL-PH control to CAL. This turns the VFO, buffer, first and second multiplier stages ON so that a calibration signal can be heard. Close the telegraph key.

(f) Continue to rotate the TUNING dial about 4.0 mc until the calibration signal is zero beat with WWV.

(g) Turn the FIDUCIAL screw until the hair line is on 4.0 mc.

(h) In like manner, the dial can be calibrated on 15,000 kc by setting the communications receiver at WWV on 15 mc and the 32V-2 TUNING dial at 15 mc on the 20M BAND position. See the following table.

WWV Frequency	Dial Setting	Oscillator Frequency	Oscillator Harmonic
10 mc	4,000	2,000	5th
15 mc	15,000	1,875	8th
15 mc	7,500	1,875	8th

3.2. OPERATION.

3.2.1. GENERAL. - The operation of this equipment is exceedingly simple once the functions of the controls are understood. The function of the controls is hereby given, followed by a step-by-step procedure for operating the equipment.

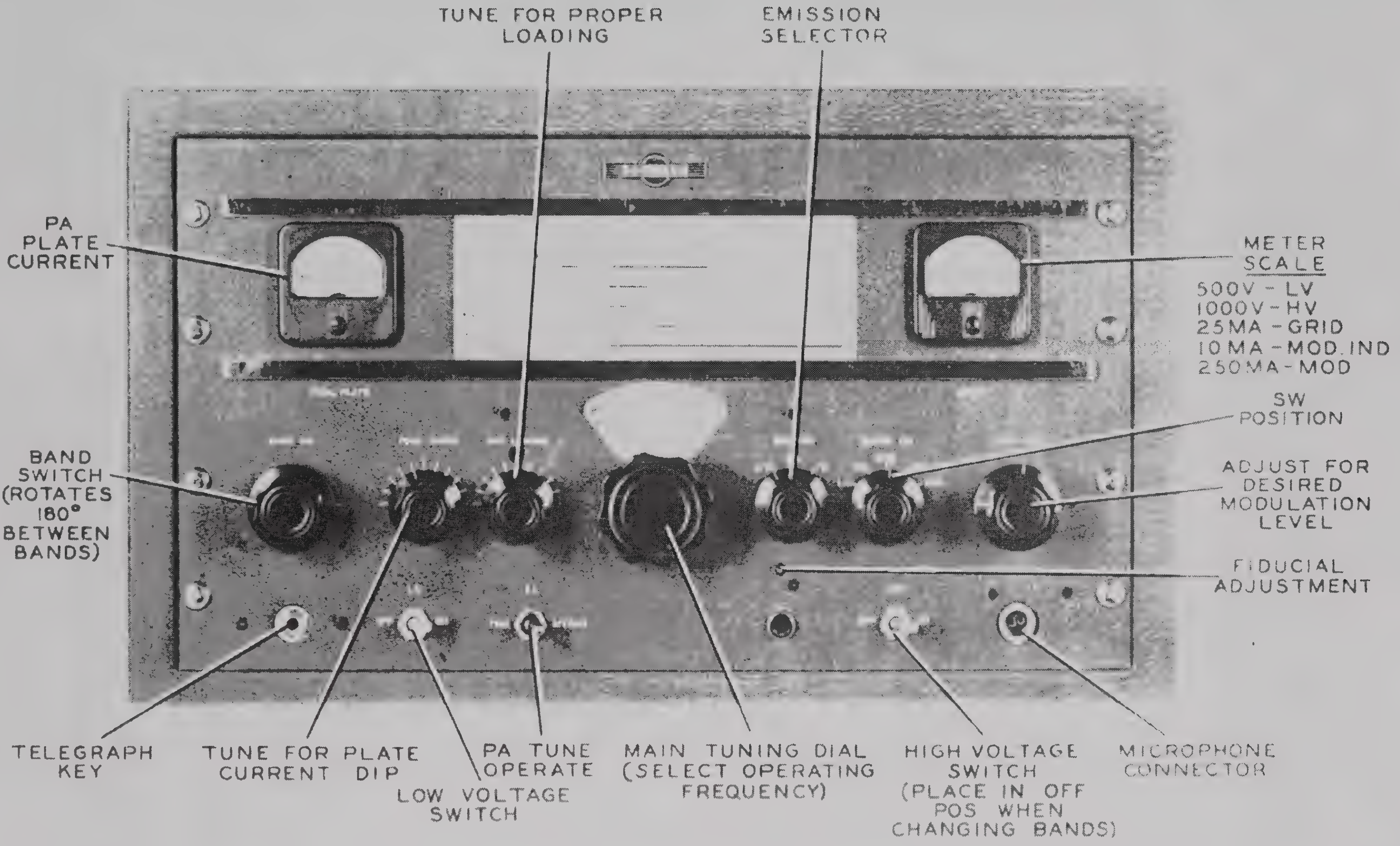


FIGURE 3-1 32V-2 CONTROL FUNCTIONS

3.2.2. FUNCTION OF CONTROLS.

(a) BAND SWITCH. - This control selects the proper tuning elements in all stages for the amateur band upon which operation is desired. The knob rotates 180 degrees between adjacent bands. Clockwise rotation selects higher frequency bands. The band selected is indicated by the band lighted slide rule dial.

(b) TUNING Control. - This control operates both the slide rule dial and the vernier dial to select the exact frequency upon which operation is desired.

(c) CW-CAL-PH Switch. - This three position switch selects the type of emission required. In the CW position, the secondary of the modulation transformer is short circuited, the screen voltage is removed from the modulator tubes, a bleeder is placed between the PA screen grid to ground and the carrier-control relay is connected so that it can be operated by the HV switch. The transmitter is ready for CW operation when the key is inserted in the KEY jack. In the CAL position, the VFO, buffer, first and second multiplier stages are in operation to supply a signal of suitable strength for zero-beating against received signals without causing interference to other stations. The carrier control relay is disconnected from the HV switch so that the associated receiver and antenna changeover relay will be in the "Receive" condition. In the PH position, the switch opens the short circuit on the secondary of the modulation transformer, closes the keying circuit, applies screen voltage to the modulator tubes and connects the carrier control relay so that it can be operated by the HV switch or a push-to-talk switch on a microphone.

(d) METER Switch. - The METER switch selects various circuits to be metered by the meter directly above the switch. This meter has 3 scales: 0-250; 0-500 and 0-1000. The table below indicates how it is used:

METER SWITCH POSITION	CIRCUIT METERED	FULL SCALE DEFLECTION READS
LV	Low voltage	500 volts
HV	High voltage	1000 volts
GRID	PA grid current (DC)	25 ma
MOD IND	Mod. grid current	10 ma
MOD	Mod. plate current	250 ma

The meter on the left reads PA Plate current only. Full scale deflection reads 500 ma.

(e) AUDIO GAIN. - This control adjusts the level of modulation in phone operation and the volume of the sidetone signal in CW operation.

(f) LV Switch. - The LV switch turns the filaments and the low voltage plate and bias supply on. (Plate voltage is not applied to the r-f exciter tubes; however, until the HV switch is turned on, except when the CW-CAL-PH switch is on CAL position.)

(g) HV Switch - The HV switch turns on the high voltage supply and connects plate voltage to the r-f exciter tube thru operation of carrier control relay K301. The push-to-talk connections are in parallel with this switch.

(h) FINAL TUNING. - This control is used to obtain resonance of the PA plate circuit. It must be reset after each adjustment of the ANT. LOADING controls.

(i) ANT. LOADING. - This control is used to obtain correct antenna tuning and loading. Start with this control in position number 1. Usually the 80 meter band will load up on positions 1, 2, or 3, the 40 meter band on 4, the 20 meter band on 5, the 15 meter band on 6, and the 10 and 11 meter bands on position 6 of the loading control.

(j) TUNE-OPERATE SWITCH. - This switch inserts some resistance in the primary of the power transformer in the TUNE position to reduce plate voltage during the tuning procedure. This switch should always be used to protect the power amplifier tube in off resonance conditions.

(k) FIDUCIAL. - This control, a small screwdriver adjustment located directly under the CW-CAL-PH knob, is used to move the vernier dial index during calibration adjustments. Once it has been set, further adjustment will be unnecessary over long periods of time.

(l) 600 - 700 v SWITCH. - This switch, located at the rear of the chassis, is used to select either 600 of 700 volts (approx.) for application to the PA plate.

(m) SIDETONE PITCH. - The sidetone pitch control is located within the cabinet near the modulator tubes. This adjustment should be set at the position which produces the most desirable tone according to individual taste.

3.2.3. OPERATION PROCEDURE.

(a) Operate the LV switch to the ON position. Allow two minutes for the tubes to heat.

(b) Turn the AUDIO GAIN to the counterclockwise stop. (off)

(c) Turn the ANT. LOADING control to position 1. (minimum loading)

(d) Place the CW-CAL-PH control in the position indicating the desired emission.

(e) Rotate the BAND switch to the band containing the desired operating frequency.

(f) Rotate the TUNING dial to the desired frequency.

(g) Place the Meter selector switch in the GRID position and close the telegraph key. (If PH emission was selected, it will not be necessary to close the key.)

(h) Place the TUNE-OPERATE switch in the TUNE position.

(i) Observing the FINAL PLATE meter, turn the HV switch ON and quickly turn the FINAL TUNING to resonance, i.e. minimum plate current dip.

(j) Observe the GRID current reading on the right hand meter. This should be between 5 and 15 ma.

(k) Operate the ANT. LOADING control clockwise until approximately 125 ma loading is obtained while keeping FINAL TUNING at resonance. Repeat this procedure until 125 ma reading is obtained with complete resonance of PA. If it is impossible to load to 125 ma PA plate current, rotate the ANT. LOADING control clockwise until proper loading is obtainable.

(l) Place the TUNE-OPERATE switch in the OPERATE position and load the PA to 180 ma with the ANT. LOADING control maintaining resonance with the FINAL TUNING control.

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Observe all safety regulations. Do not change tubes or make adjustments inside equipment with the high voltage supply ON. Do not depend upon door interlocks for protection but always turn the high voltage supply OFF. SWITCH TO SAFETY.

(m) If CW emission was selected, the telegraph key can be opened and the transmitter keyed. If PH (phone) emission is selected, turn the METER switch to MOD. and observe the static (resting) modulator plate current. This should be about 50 ma for the 600 v position of the 600 - 700 v switch at rear (55 ma on the 700 v position). Advance the AUDIO GAIN control while speaking in normal tones into the microphone until the modulator plate current swings to about 100 ma on peaks. This will result in approximately 100% modulation with voice input. If desired, a more exact check of modulation level can be made with an oscilloscope while observing the proper meter swing for the voice of the individual operator.

With sine wave input, the modulator plate current will read about 200 ma for 100% modulation.

With the METER switch set to MOD. IND., a slight kick of the needle indicates approximately 100% modulation on voice peaks. This is useful as an alternate method of indicating modulation level, since no deflection occurs on the meter until the modulation level reaches approximately 55%. The level at which the meter kicks depends somewhat upon the loading of the final amplifier and characteristics of the modulator tubes.

NOTE

In step (g) above, the key plug can be pulled from the key jack since this is a closed circuit type jack.

CAUTION

When changing BANDS, place the HV switch in the OFF position. Also place the PUSH-TO-TALK switch in the OFF position.

NOTE

If the 600 - 700 v switch is placed in the 700 v position, the PA plate current should be 220 ma.

3.2.4. TYPICAL METER READINGS. (PH position without modulation.)

	LV	HV	GRID	MOD	FINAL PLATE BOTH PHONE & CW
600 v	240	580	10	50	180
700 v	240	720	10	55	220

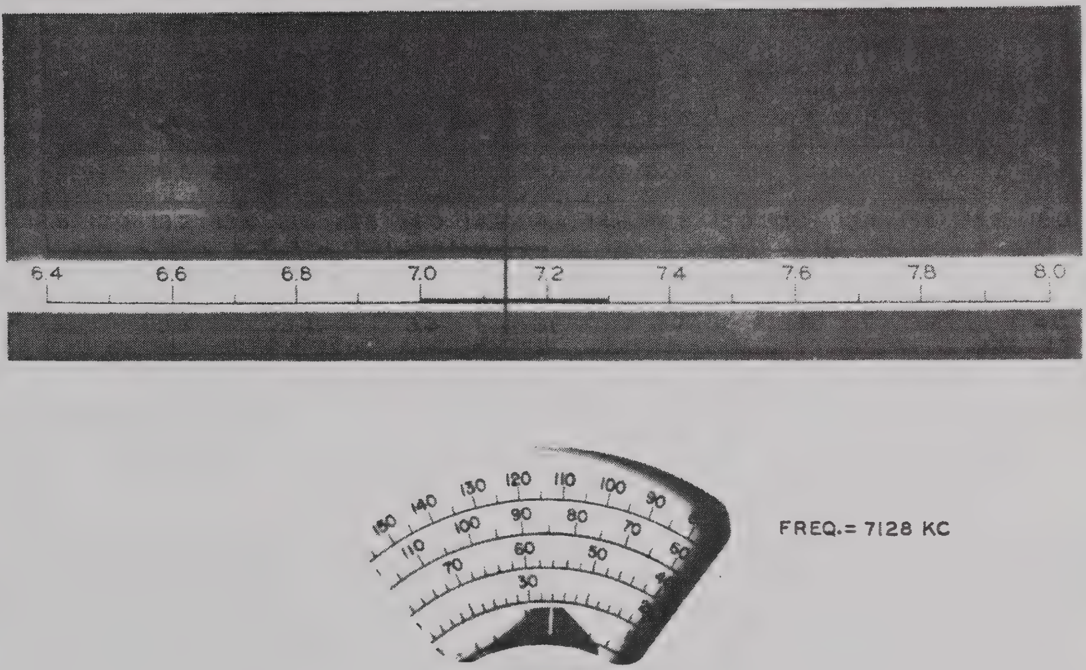
3.2.5 DIAL CALIBRATION. - When changing BANDS, the proper scale on the slide rule dial is illuminated automatically as the BAND switch is rotated. At the same time, the vernier dial fiducial moves up or down the vernier dial face and stops at the corresponding scale to which the slide rule dial is positioned.

The dial is read by combining the vernier dial reading with the slide rule dial reading. The exact method varies somewhat from the low frequency bands to the high frequency bands and can best be learned by referring to figure 3-2.

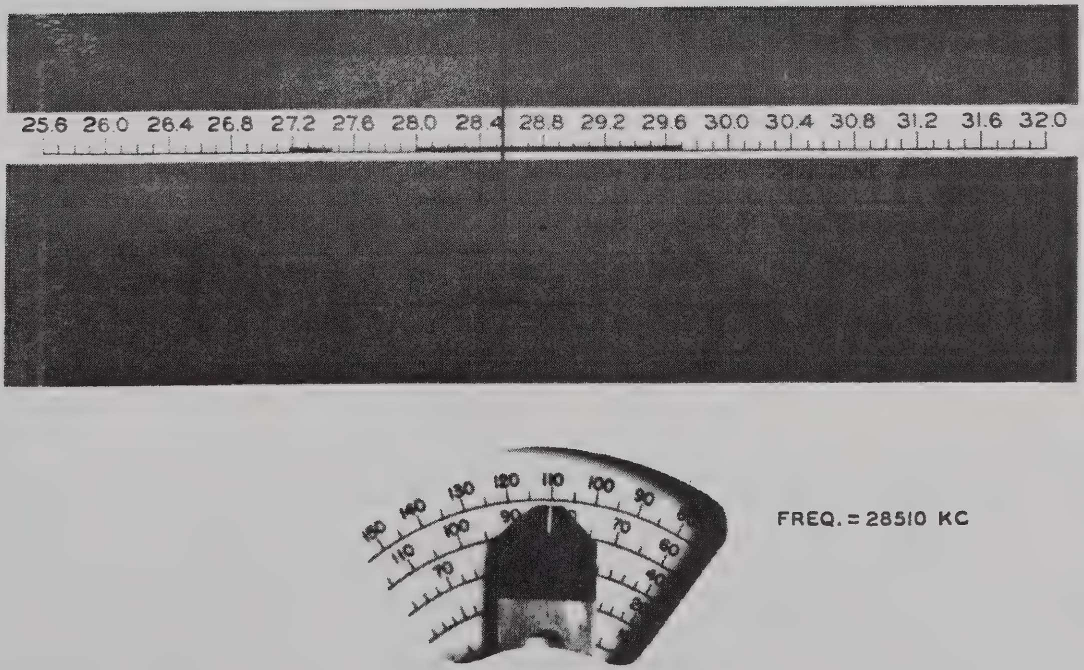
3.2.6. ANTENNA LOADING TABLE. - This table indicates the approximate position for the antenna loading control for loading into various antenna impedances on the different bands.

POSITION OF ANT. LOADING CONTROL
(for resistive loads)

FREQ MC	26 ohm LOAD	50 ohm LOAD	100 ohm LOAD	300 ohm LOAD
3.5	2	2	2	2
4.0	3	3	3	4
7.0	4	4	4	4
7.3	4	4	4	4
14.0	5	5	5	5
14.4	5	5	5	5
21.0	6	6	6	6
21.45	6	6	6	6
27.2	6	6	6	6
28.0	6	6	6	6
29.7	6	6	6	6



FREQ.= 7128 KC



FREQ. = 28510 KC

FIGURE 3-2 TYPICAL DIAL READINGS

SECTION 4

CIRCUIT DESCRIPTION

4.1. GENERAL. - The following paragraphs have been written to enable the owner of a 32V-2 to understand the functioning of his transmitter more fully. This section should be read and understood before any extensive servicing is attempted.

4.2. CIRCUIT DESCRIPTION.

4.2.1. RF CIRCUITS.

(a) OSCILLATOR - A type 6SJ7 tube is employed in a highly stabilized master oscillator circuit to generate the controlling radio frequency voltage. This frequency generating unit is a linearly - tuning permeability tuned oscillator with a range of 1.6 to 2 megacycles. Sixteen turns of the main tuning dial cover this range. This provides 50 KC per revolution of the second harmonic (3.2 to 4 mc band). With the end points properly set up, the tuning curve is linear within one dial division of the ideal tuning curve on any of the bands in the operating range. The oscillator circuit is compensated for temperature changes and is entirely enclosed in a heavy aluminum case.

(b) INTERMEDIATE STAGES. - Following the master oscillator, a type 6AK6 is employed in an untuned, Class A amplifier stage. This stage completely isolates the master oscillator from the remaining tuned stages. The 6AK6 drives a series of three frequency multiplier tubes, the first of which is a type 6AG7. The operating frequencies at the plate of the multiplier tubes for the different bands is given in the following table:

	1ST MULT. 6AG7	2ND MULT. 7C5	3RD MULT. 7C5
80M	3.5 mc	3.5 mc	3.5 mc
40M	3.5 mc	3.5 mc	7 mc
20M	3.5 mc	7 mc	14 mc
15M	5.75 mc	10.5 mc	21 mc
11M	6.8 mc	13.6 mc	27 mc
10M	7 mc	14 mc	28 mc

Plate screen and filament power for these stages is obtained from the low voltage power supply. Gang tuning of the multiplier stages is obtained by moving powdered iron cores, attached to a common platform, in and out of the plate coils which are wound to give linear tuning. This platform to which the iron cores are attached is also ganged to the master oscillator tuning for complete, single control tuning of the exciter stages. Band switching is accomplished by adding extra padding capacity across coils by means of the band switch in all cases excepting the 14 mc output of the third multiplier where an inductance is switched in in parallel with the existing 40 meter inductor to lower the tuning inductance for 14 mc output.

(c) POWER AMPLIFIER STAGE. - A type 4D32 tetrode power amplifier tube is used in the PA stage. This tube always operates as a straight amplifier. The plate circuit is tuned by a combination pi-network and "L" network which is band-switched along with the multiplier stages. The combination network reduces the output impedance to around 50 ohms on all bands by means of inductance and capacitance switching. The output network will actually operate satisfactorily with antenna impedances in the range 26 to 600 ohms. It is also effective in reducing harmonic output of the transmitter. The screen grid and plate of the 4D32 are both modulated in phone transmission. Plate and screen voltage is obtained from the high voltage supply while filament power is obtained from the low voltage plate supply transformer. The tube is biased with 75 volts of fixed-bias plus some grid leak bias.

4.2.2. AUDIO CIRCUITS. - The first and second audio amplifier consists of a type 6SL7 tube operated as a cascade amplifier. A volume control, R205, is located in the grid circuit of the second amplifier stage. The driver stage employs a type 6SN7 tube with the two triode sections operated in parallel to drive the modulator stage. The modulator stage utilizes a pair of type 807 tubes connected in a push pull circuit and operating class AB_2. The output of the modulator is coupled to the final amplifier by transformer, T202, to modulate the plate and screen of that stage. During CW operation, the secondary of the modulation transformer is shorted out by S302A. Bias for the modulator tubes is adjustable by R305, and obtained from the low voltage supply and regulated by the voltage regulator tube, V304, type VR-75. The secondary of the modulation transformer has a 500 ohm tap provided for supplying 60 watts of audio power to an external load.

4.2.3. HIGH VOLTAGE SUPPLY. - The high voltage transformer is energized when the contacts of relay, K301, are closed. The high voltage supply employs two type 5R4GY rectifier tubes connected in parallel in a full wave circuit. The output is filtered by a single section choke input filter. This supply furnishes voltage for the plate and screen of the final amplifier and plate voltage for the modulator tubes. The amount of output voltage from this supply may be either 600 volts or 700 volts depending on the position of the tap switch, S305, in the primary winding of the high voltage transformer, T302. For the same power input, the efficiency of the final amplifier improves with the higher operating voltage. The tube manufacturer recommends no more than 600 plate volts for phone operation, but this is for CCS rating. A pair of 15 ohm resistors are connected in series with the HV plate transformer primary for "tune-up". These are shorted out when operating.

4.2.4. LOW VOLTAGE SUPPLY. - Transformer, T301 furnishes power for both the low voltage plate supply and the filament of all tubes in the transmitter. T301 is energized by closing the LV switch, S304. Three separate windings on transformer, T301, furnishes filament power to the tubes. The low voltage plate supply employs a type 5Z4 rectifier tube in a full wave circuit with a two section choke input filter. This supply has a total output voltage of approximately 315 volts, 240 volts is supplied to the audio amplifier, oscillator, buffer and multiplier stages. Bias voltage for the modulator and final amplifier stage is furnished by this supply. It also supplies voltage for the operation of relay, K301.

4.2.5. RECEIVER MUTING CIRCUIT. - Users of the Collins Model 75A receiver can take advantage of the cw muting circuit contained therein. This muting is accomplished by blocking the noise limiter circuit in the receiver with a positive voltage. In the 32V-2 transmitter this positive voltage is obtained from the voltage drop across the cathode resistor of the second multiplier tube, V103. The receiver limiter switch should be in the OUT position during CALIBRATION adjustments of the 32V-2 and in the IN position when muting is desired on CW operation.

SECTION 5

MAINTENANCE

5.1. INSPECTION.

5.1.1. GENERAL. - This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5.1.2. ROUTINE INSPECTION. - Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects and deterioration of components.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is suggested that this inspection be made as frequently as possible and it should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

(a) CLEANING. - The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion, itself, is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity acculumates in any part of the equipment. It is very important that rotating equipment, such as variable condensers and tap switches, be kept free from dust to prevent undue wear. Likewise, variable condenser plates should be kept free from dirt to avoid flashover.

One of the greatest sources of trouble in equipment located in a salt atmosphere is corrosion. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as tap switches, tube prongs, cable plug connectors, and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

(b) VACUUM TUBES. - Make a check of emission characteristics of all tubes. After the emission check, examine the prongs on all tubes to make sure that they are free from corrosion. See that all tubes are replaced correctly and fully in their sockets, and a good electrical contact is made between the prong of the tube and the socket. Use caution in removing and replacing grid or plate caps on tubes so equipped. Before a tube is discarded, make certain that the tube is at fault and the trouble is not a loose or broken connection within the equipment. A complete set of tested tubes of the same type specified should be kept on hand at all times. If faulty operation of the transmitter is observed and tube failure suspected, each tube may be checked by replacing it with a tube known to be in good condition. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit.

If tubes have been in use for a period of time equal to or exceeding the manufacurer's tube life rating, it is suggested that they be replaced. A marked improvement in the performance of the equipment is usually noticeable after the weak tubes have been replaced.

(c) PRECAUTIONS FOR SATISFACTORY TUBE LIFE.

(1) Before any tube is removed from the equipment, make certain the primary power is disconnected from the equipment.

(2) Operate all tubes within ±5% of rated filament voltage.

(3) Do not exceed the rated plate current of any tube during normal operation of the equipment.

(d) TUBE REPLACEMENT PRECAUTIONS.

(1) All tubes are removed by pulling them straight away from the chassis.

(2) Remove plate cap connectors, from tubes so equipped, with great care to prevent breaking the seal around the plate cap.

(3) Before a tube is inserted, make certain that the type of tube is correct for the socket into which it is being placed.

NOTE

Changing master oscillator tubes (V001) may cause a slight change in master oscillator calibration.

(e) TUBE TABLE.

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V001	6SJ7	Master oscillator	6.3
V101	6AK6	Buffer amplifier	6.3
V102	6AG7	Frequency multiplier	6.3
V103	7C5	Frequency multiplier	6.3

TUBE TABLE

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V104	705	Frequency multiplier	6.3
V105	4D32	Power Amplifier	6.3
V201	6SL7	Audio Amplifier	6.3
V202	6SN7	Audio driver	6.3
V203	807	Modulator	6.3
V204	807	Modulator	6.3
V205	6SL7GT	Sidetone Oscillator	6.3
V301	5Z4	LV Rectifier	5.0
V302	5R4GY	HV Rectifier	5.0
V303	5R4GY	HV Rectifier	5.0
V304	VR75	Bias Regulator	---
V305	OA2	Screen Voltage Limiter	---
V306	OA2	Screen Voltage Limiter	---

(f) RELAYS. - All relays should be inspected at regular intervals. Check the contacts for proper alignment, pitting and corrosion. Use a burnishing tool to clean contacts - never use sandpaper or emery cloth.

5.2. TROUBLE SHOOTING.

5.2.1. GENERAL. - The most general cause of improper operation of radio equipment is tube failure. Refer to paragraph 5.1.2., (b) in this section for comments concerning vacuum tube replacement. Defective tubes causing an overload in power circuits may usually be located by inspection. High voltage arcs may be caused by bent condenser plates, corrosion or dust. Corrosion resulting from operating the equipment in a salt laden atmosphere may cause failure of the equipment for no apparent reason.

In general, trouble encountered in radio apparatus may be isolated by means of various tests and measurements, and the section of the transmitter determined in which the trouble is located. If this is done, the components in the associated circuit may be checked and the trouble located. Refer to the tables of meter readings and resistance measurements.

No one but an authorized and competent service man equipped with proper test facilities should be permitted to service this equipment.

5.2.2. FUSES.

(a) GENERAL. - This equipment is supplied with fuses of the correct rating in each position. Fuse failures should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Always replace a fuse with the rating specified in the following table:

FUSE TABLE

SYMBOL	LOCATION	TYPE	RATING
F301	LV Power supply primary	Cartridge (3AG)	3 amp.
F302	HV Power supply primary	Cartridge (3AG)	5 amp.

5.3. ALIGNMENT.

5.3.1. GENERAL. - Should, for any reason, the exciter stages get out of alignment, it is recommended that the unit be realigned at once. Improper operation might result in damage to valuable equipment.

5.3.2. HIGH FREQUENCY OSCILLATOR. - Should trouble develop in the high frequency master oscillator, the unit should be returned to the factory for servicing. However, the unit can be serviced and realigned by persons understanding such techniques providing accurate test equipment is at hand. A crystal controlled frequency standard with outputs at 1700 and 2000 kc with an accuracy of better than .015 percent, must be used for setting the band edges.

(a) PROCEDURE.

(1) Apply power to the transmitter and let the MO warm up for about 30 min. then check the oscillator frequency on a receiver. Operate the transmitter with the emission control in the CAL position and the key closed.

(2) Couple a receiver to the output of the oscillator.

(3) Set the vernier index to exact center of the dial window.

(4) Tune receiver to output of 1700 kc freq. standard.

(5) Rotate MO to vicinity of 3400 kc on the exciter dial and zero beat with the signal from the standard. Write dial reading down for use as a reference.

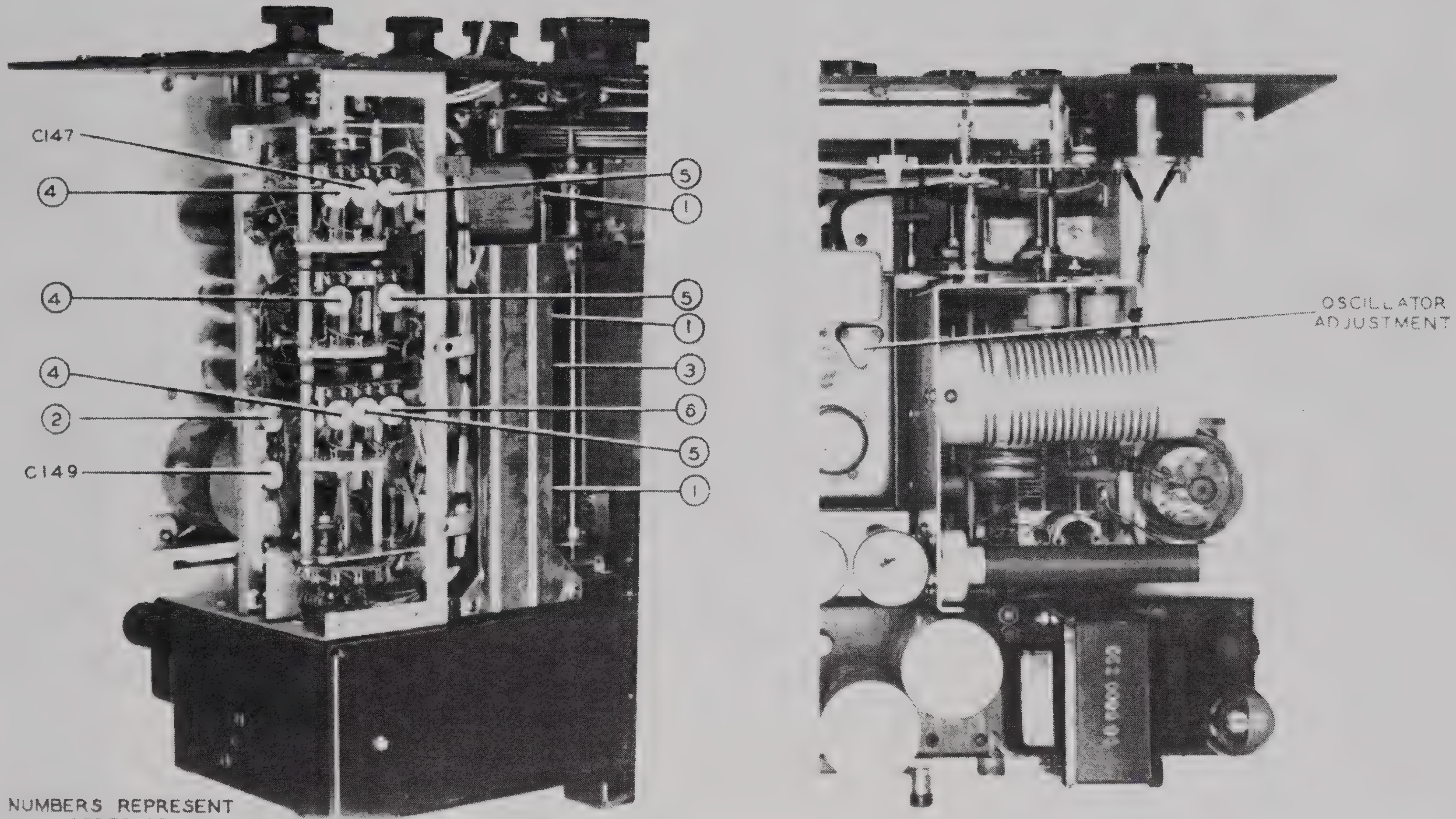
(6) Rotate the MO dial toward 4 mc exactly 12 turns.

(7) Tune the receiver to the 2000 kc output of the standard.

(8) The MO should zero beat with the 2000 kc output of the standard at exactly 12 turns of the MO dial.

(9) If such is the case but the dial reading is incorrect, loosen the set screws in the oscillator coupler and turn the dial to the correct reading (4000 kc) after which tighten the set screws again. If the MO does not zero beat with the standard at 4 mc, proceed as follows:

(10) Read the kc difference (the difference of where the signal appeared from where it should have appeared after 12 turns) and multiply it by 5. Add this figure to the actual beat note dial setting if the beat note was less than 12 turns or subtract it if the beat note occurred at more than 12 turns. Now set the dial to this new frequency, remove the trimmer plug from the top of the oscillator, and turn the adjustment until zero beat is again reached. It will be found that the high and low ends are very nearly 12 turns apart. Repeat the above procedure until such is the case; remember that a new reference point will occur at the low end of the dial each time.



NUMBERS REPRESENT ORDER OF ADJUSTMENT (SEE TEXT)

BOTTOM

TOP

FIGURE 5-1 ALIGNMENT ADJUSTMENTS

Examples of above operations:

#1

Beat note at low end of dial = 3402 kc
Reading at which beat note should appear after 12 turns of dial = 4002 kc
Actual dial reading = 4003 kc
Difference frequency (4003 - 4002) = 1 kc
Multiplied by 5 = 5 kc
Subtracted from 4003 (since beat note occurred at more than 12 turns) = 3998 kc

After setting dial to 3998 kc and zero beating the MO to the standard with the trimmer adjustment, the low end beat note should appear at 3398 kc.

#2

Beat note on low end of dial = 3498 kc
Reading at which dial should appear after 12 turns = 3998 kc
Actual dial reading = 3996 kc
Difference frequency (3998 - 3996) = 2 kc
Multiplied by 5 = 10 kc
Added to 3996 (since beat note occurred at less than 12 turns of the dial) = 4006 kc

After setting the dial at 4006 and zero beating the MO to the standard with the trimmer adjustment, the low end beat note should appear at 3406 kc.

(11) After the oscillator has been adjusted to cover the range 3400 to 4000 kc in exactly 12 turns, the coupler set screws can be loosened and the dial set on frequency.

NOTE

The above method of adjustment is that which is used at the factory. This is a short cut method and proves very reliable. Actually, the object is to get the 1700 kc and the 2000 kc outputs of the oscillator exactly 12 turns apart and it can be attained by using the slower method of moving the trimmer capacitor in one direction or the other and checking the results until the desired answer is obtained. Be sure to replace the trimmer cover plug after alignment.

NOTE

Somewhat greater accuracy can be obtained if the oscillator end points are set using harmonic operation i.e. listen in the 14 or 28 mc region for the harmonics of the 1700 and 2000 kc signals and set the corresponding harmonic of the MO to zero beat with these. Do this only after obtaining a very close adjustment as outlined above.

5.3.3. MULTIPLIER STAGES. - Should the grid drive to the final fall below 5 ma on the meter due to change of tubes or aging of components, the transmitter r-f circuits should be realigned. Proceed as outlined below only after the master oscillator has been checked and recalibrated as outlined in paragraph 5.3.2.

A small fiber screwdriver and a 1/4" open end wrench are required for these adjustments.

(a) PROCEDURE.

(1) Remove the transmitter from the cabinet and tip it up on end. (RF section up).

(2) Remove the fuse from the HV primary. (This allows the low voltage supply to be turned on while the HV supply remains turned off.)

(3) Turn the LV and HV power switches ON.

(4) Place the CW-CAL-PH switch in the PH position.

(5) Place the METER selector switch in the GRID position.

(6) Adjust for maximum grid current using the adjustments and conditions listed below in order from top to bottom of the list. (Refer to figure 5-1 for adjustment identification.)

ORDER OF ADJUSTMENT	BAND SW SET AT	TUNING SET AT	ADJUSTMENT
1	10M	28,800	3 Slugs marked "28.8"
2	40M	7,300	C150
3	40M	7,200	1 Slug marked "7.2"
4	15M	21,600	3 Trimmers marked "21.6"
5	20M	14,250	3 Trimmers marked "14.4"
6	80M	3,750 kc	1 Trimmer marked "3.6"

NOTE

In item 4 under ADJUSTMENT, the mistracking of the third multiplier plate circuit will result in low grid current when the main tuning dial is set much outside the limits of the amateur 20 meter band (14 to 14.4 mc). Proper grid current can be obtained at any frequency on the range 12.8 - 16 mc by adjustment of trimmer C137 (marked 14.4) on the third multiplier.

NOTE

If extensive multiplier alignment has been necessary, it is likely that the two spurious signal traps will need tuning. Do not touch the spurious signal tuning condensers unless this is so, since these adjustments are very critical. The spurious signal trap tuning condenser for the 80 meter band, C149 is located on the side of the multiplier unit next to C150, see figure 5-4. These traps are tuned as follows: With the transmitter aligned as indicated in the above paragraphs, tune the transmitter for 3.5 mc output and listen with a receiver to the 1.75 mc output. Watching the receiver "S" meter, tune C147 for minimum signal. Then tune the transmitter up on 7.15 mc and listen on 3.575 mc with the receiver. Adjust C149 for minimum signal. Both of these adjustments will be very sharp and care should be taken that they are not disturbed in the least after the adjustments have been made. Replace the multiplier bottom cover.

5.3.4. MODULATOR BIAS ADJUSTMENT. - The modulator bias can be adjusted by turning the screwdriver slot equipped potentiometer R305. For best distortion characteristics, the static, or resting, modulator plate current should be 55 ma with the 600 - 700 v switch in the 700 v position. Potentiometer R305 is located within the top of the cabinet near the filter capacitors, therefore, the interlock switch will have to be held closed while making this adjustment. Take great care to avoid touching any components carrying high voltage.

The proper bias for the modulator grids is approximately minus 25 volts.

5.4. LUBRICATION. - The following parts should be lubricated annually or whenever the need arises by brushing a thin film of the indicated lubrecant on the points of mechanical contact. Don't over-lubricate.

(a) PA Bandswitch Contacts: MOBILE PD535A (Socony Vacuum Oil Co.)

(b) Panel Bushings: MOBILE PD535A (Socony Vacuum Oil Co.)

5.5. OSCILLATOR TUBE REMOVAL. - Replacing an oscillator tube requires the breaking of the seal around the shield and it will then become necessary to reseal the shield. If it becomes necessary to replace an oscillator tube, use a glyptal cement or a generous application of Duco cement to reseal the shield.

5.6. DESICCANT CAPSULE. - A silica-gel tube is mounted on the top of the oscillator shield. The silica-gel absorbs moisture from within the oscillator and aids in retaining the oscillator calibration. Moisture causes the color of the silica-gel to change from blue to pink. The silica-gel tube is screwed into a hole in the shield. The plastic tube should be replaced by a new tube of silica-gel when all of the material within the tube has changed from blue to pink. New tubes of silica-gel may be ordered from the Collins Radio Company.

NOTE

The seal around the oscillator tube shield and the silica-gel tube is more easily broken if the parts are warm. This can be done safely with a light bulb or infra-red lamp placed close to the oscillator.

TYPICAL TEST VOLTAGES

DC Voltages to Ground measured with Volt-ohmyst. Conditions: Phone - No Mod. Readings taken at LF end of each band.

Tube	Pin	R.F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V101	6AK6						
G1	1	-17.0	-16.5	-1.0	-0.9	-1.0	-0.9
K	2, 7	1.0	1.0	2.9	2.85	2.85	2.9
P	5	235	230	230	225	225	225
G2	6	155	150	65	65	65	65
V102	6AG7						
K	1,3,5	2.6	2.6	3.9	3.2	3.4	3.2
G1	4	-18.	-18.	-36	-36	-38	-36
G2	6	220	215	205	205	205	210
P	8	230	230	220	220	225	225

Tube	Pin	R.F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V103	7C5						
P	2	235	235	215	210	215	215
G2	3						
G1	6	-24.	-23.	-56.	-21.	-69.	-51.
K	7	25.	25.	27.	27.	26.	26.
V104	7C5						
P	2	225	220	215	215	215	215
G2	3						
G1	6	-115	-110	-170	-175	-150	-150
K	7	-59	-56	-52	-52	-51	-50
V105	RK-4D32						
G2	2	285	300	300	300	295	295
K	4, 5	0	0	0	0	0	0
G1	6	-120	-100	-93	-105	-105	-102
P	Cap	690	680	690	690	690	690

DC Voltages to Ground in Audio System (Volt-ohmyst)

4D32 Plate Current = 220 MA $E_p = 700$ V Key Down

Audio Amplifier V201, 6SL7GT				Driver V202, 6SN7GT			Modulator V203, & 4, 807			Sidetone Osc. V205, 6SL7GT		
		PH	CW		PH	CW		PH	CW		PH	CW
Pin 1	G	-0.6	-0.8	G	0	0				G	-.5	-3.0
2	P	88.	-0.9	P	235	235	G2	235	0	P	-.8	25
3	K	0	0	K	7.4	7.4	G1	-25	-25	K	0	0
4	G	0	0	G	0	0	K	0	0	G	-.3	-0.5
5	P	100	100	P	235	235	---	---	---	P	-.8	24
6	K	0.8	0.8	K	7.4	7.4	P	720	740	K	0	---
7												
8												

Key up - key down conditions of V105 (4D32)
CW operation
f = 7 mc

	Key up	Key down
Plate E	820	740
Plate I	0	220
Screen E	300	300

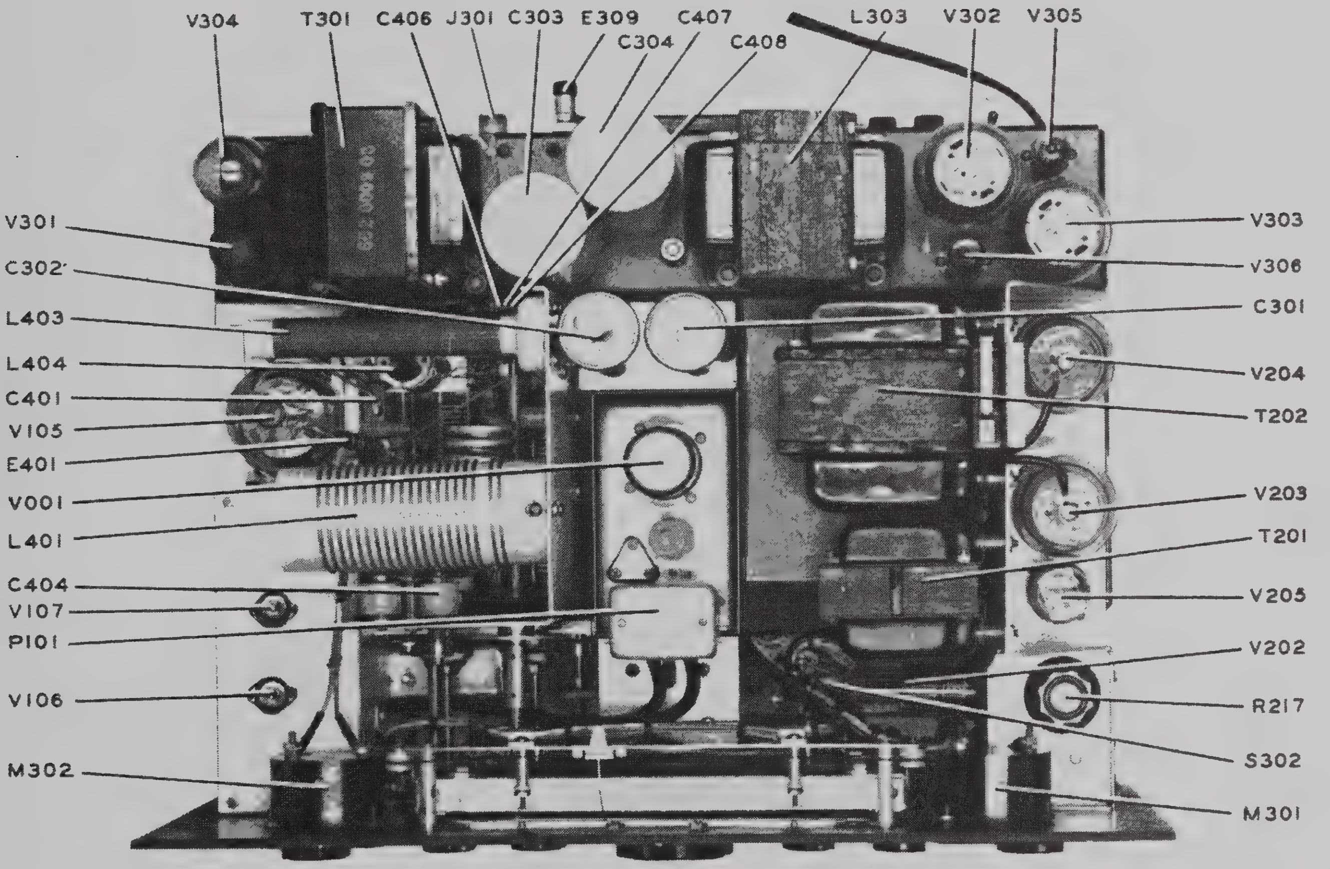


FIGURE 5-2 32V-2 PARTS ARRANGEMENT - TOP VIEW

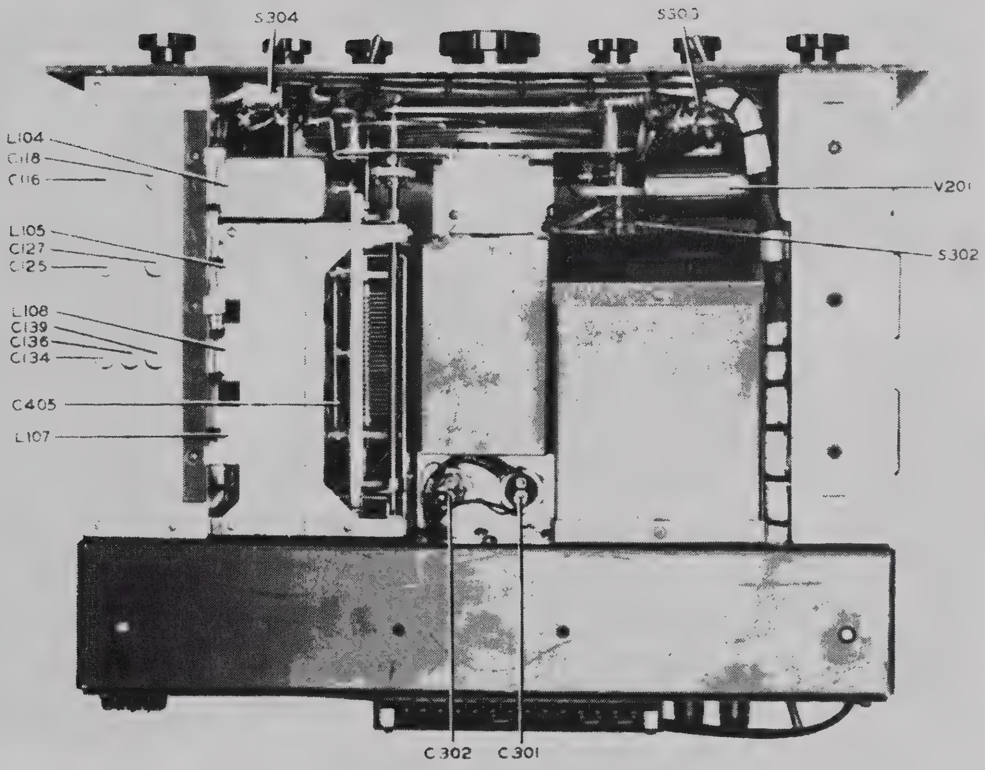


FIGURE 5-3 32V-2 PARTS ARRANGEMENT-BOTTOM VIEW

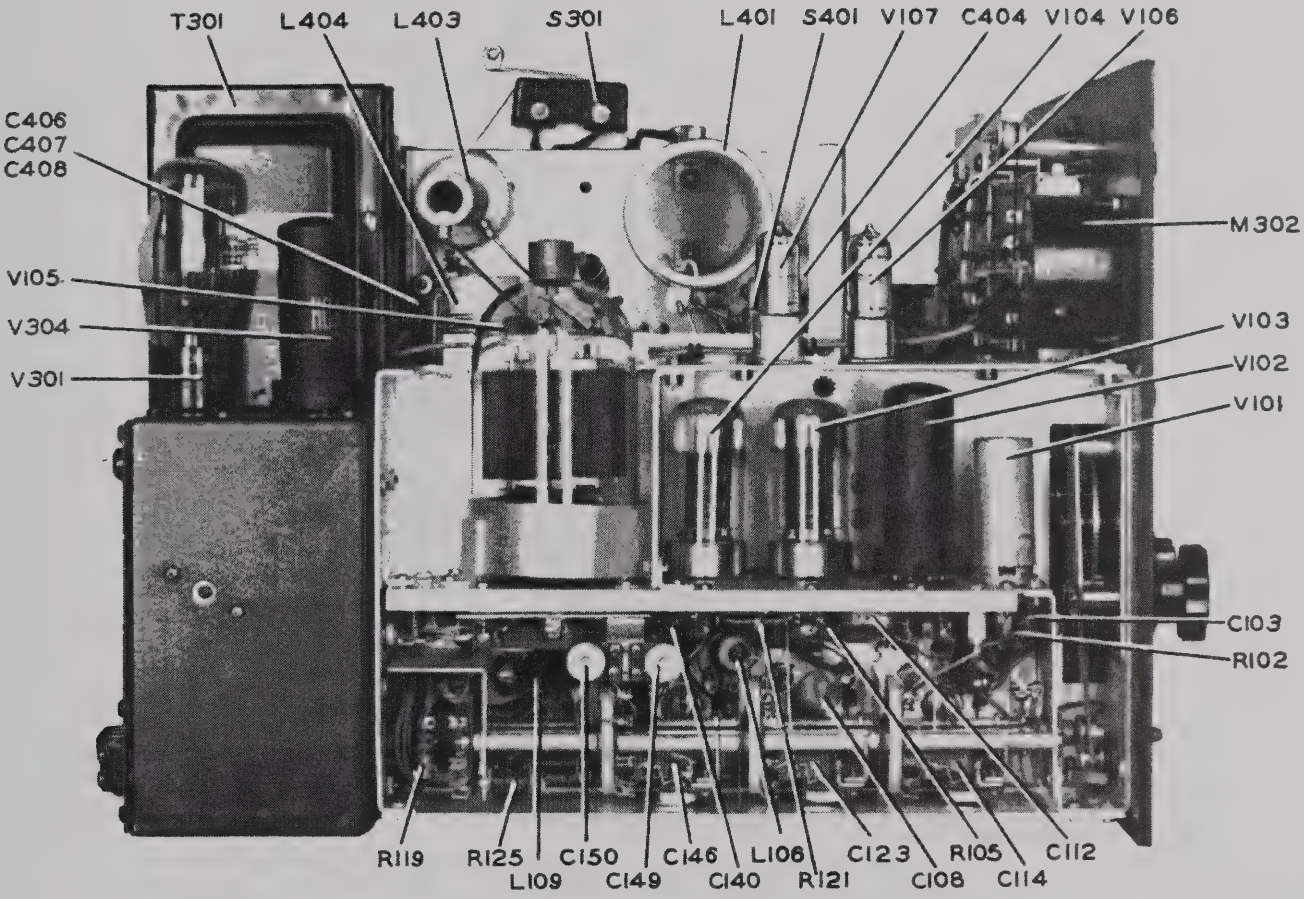


FIGURE 5-4 32V-2 PARTS ARRANGEMENT-LEFT SIDE OPEN

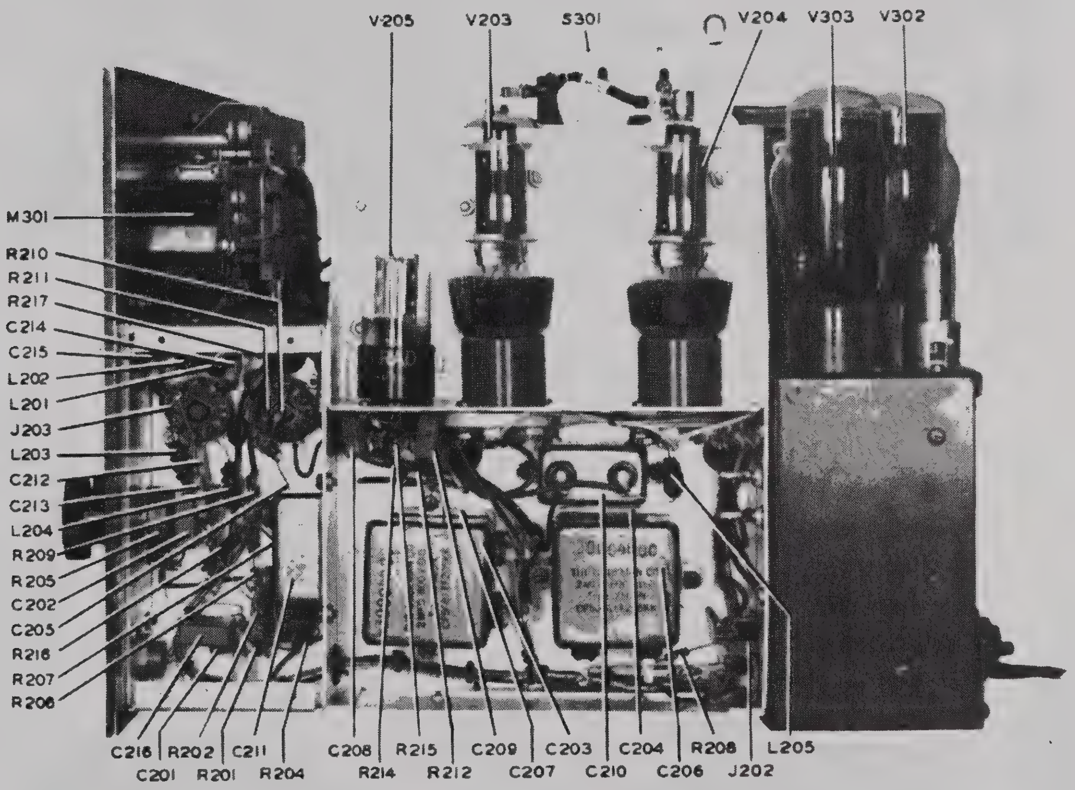


FIGURE 5-5 32V-2 PARTS ARRANGEMENT - RIGHT SIDE OPEN

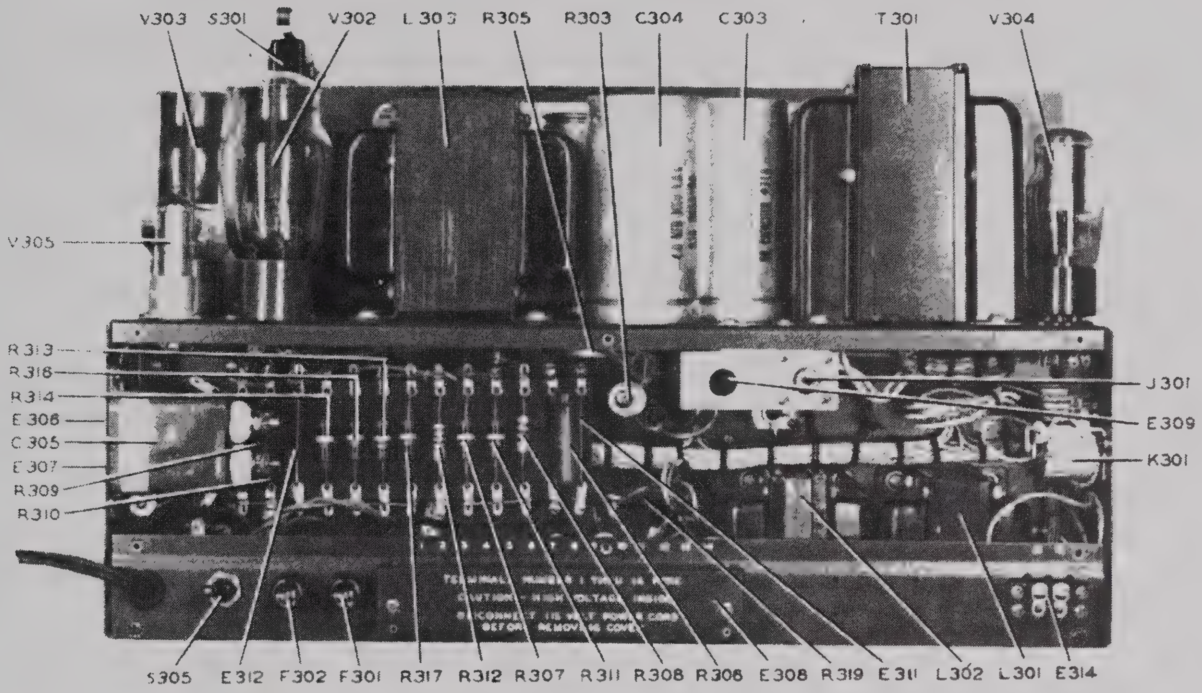


FIGURE 5-6 32V-2 PARTS ARRANGEMENT-REAR OPEN

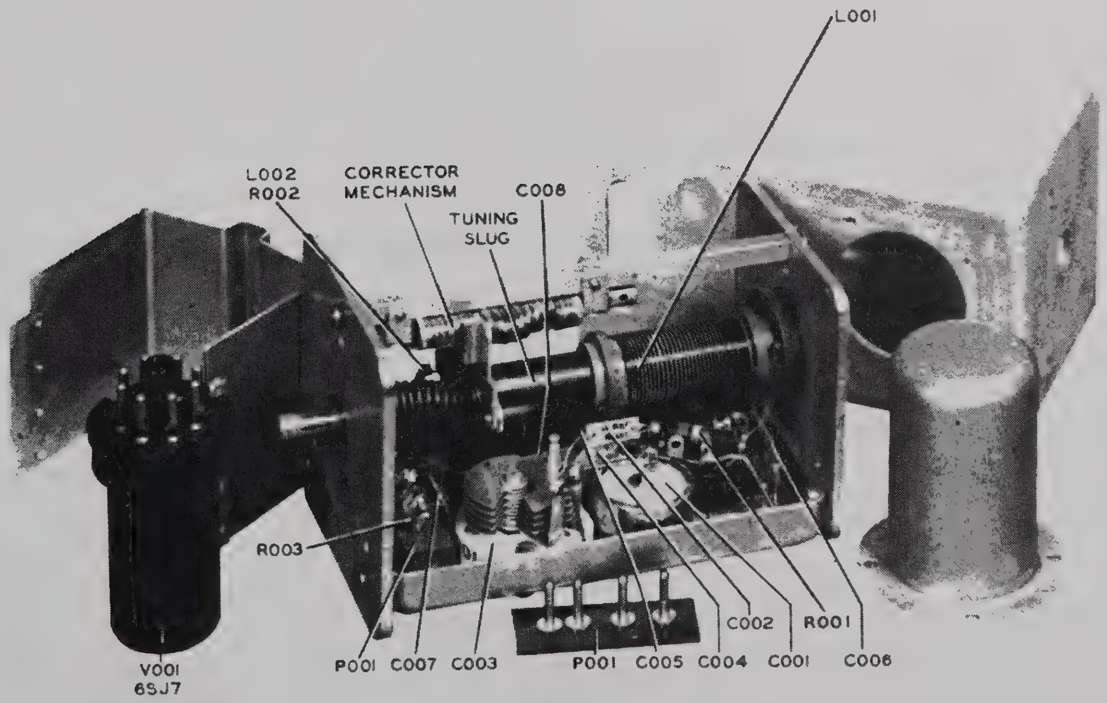


FIGURE 5-7 PARTS ARRANGEMENT 70E-8-OPEN

SECTION 6
PARTS LIST

32V-2 TRANSMITTER

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C101	Buffer Amp. Coupling	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C102	Osc. Plate Filter	CAPACITOR: Ceramic; 10,000 mmf p/m 20% 350 WV	913 0106 00
C103	Buffer Grid Voltage Divider	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C104	Buffer Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C105	Buffer Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C106	Buffer Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C107	1st Mult. Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C108	1st Mult. Grid By-pass	CAPACITOR: Paper; 100,000 mmf p/m 10%; 400 WV	931 3020 00
C109	1st Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C110	1st Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C111	Key Click Filter	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C112	2nd Mult. Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C113	1st Mult. Plate By-pass	CAPACITOR: Mica; 650 mmf p/m 2%; 500 WV	935 5061 00
C114	1st Mult. Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 5%; 500 WV	935 0077 00
C115	1st Mult Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 10%; 500 WV	935 0078 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C116	1st Mult. Plate Tuning	CAPACITOR: Ceramic 8-50 mmf; 350 WV	917 1038 00
C117	1st Mult. Plate Tuning	CAPACITOR: Mica; 180 mmf p/m 5%; 500 WV	935 0116 00
C118	1st Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C119	2nd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C120	2nd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C121	2nd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C122	3rd Mult. Coupling	CAPACITOR: Ceramic; 100 mf p/m 10%; 500 WV	916 4003 00
C123	2nd Mult. Plate Tuning	CAPACITOR: Mica; 20 mmf p/m 5%; 500 WV	935 0076 00
C124	2nd Mult. Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 10%; 500 WV	935 0078 00
C125	2nd Mult Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C126	2nd Mult. Plate Tuning	CAPACITOR: Mica; 150 mmf p/m 2%; 500 WV	935 0184 00
C127	2nd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C128	3rd Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C129	3rd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C130	3rd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C131	3rd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C132	3rd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C133	2nd Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C134	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C135		CAPACITOR: Not Used	
C136	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C137	3rd Mult. Plate Tuning	CAPACITOR: Mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C138		CAPACITOR: Not Used	
C139	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C140	PA Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C141	PA Grid By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C142	PA Screen By-pass	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C143		CAPACITOR: Not Used	
C144	PA Filament By-pass	CAPACITOR: Mica; 500 mmf p/m 20%; 500 WV	912 0302 00
C145	3rd Mult. Plate Blocking	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C146	3rd Mult. Plate Tuning	CAPACITOR: Mica; 20 mmf p/m 5%; 500 WV	935 0076 00
C147	160 Meter Tap Tuning	CAPACITOR: Ceramic 8-50 mmf; 350 WV	917 1038 00
C148	80 Meter Tap Fixed Tuning	CAPACITOR: Mica, 120 mmf p/m 5%; 500 WV	935 0109 00
C149	80 Meter Tap Var. Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C150	L108 Trimmer	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C201	Audio Input r-f filter	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C202	Audio coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C203	V201 Plate by-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C204	V201 Plate by-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00
C205	Driver grid coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C206	Driver cathode by-pass	CAPACITOR: Paper 2 mf p/m 10%; 600 WV	930 0046 00
C207	Mod. cathode by-pass	CAPACITOR: Paper, 2 mf p/m 10%; 600 WV	930 0046 00
C208	Sidetone feedback	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C209	Sidetone feedback	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C210	Sidetone coupling	CAPACITOR: Paper; .5 mf p/m 20%; 600 WV	956 2086 40
C211	Audio plate decoupling	CAPACITOR: Paper; .5 mf p/m 20%; 600 WV	956 2086 40
C212	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C213	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C214	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C215	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C216		CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C301	LV rect. filter	CAPACITOR: Paper; 4 mf plus 40 -15%; 600 WV	961 3005 00
C302	LV rect. filter	CAPACITOR: Paper; 4 mf plus 40 -15%; 600 WV	961 3005 00
C303	HV rect. filter	CAPACITOR: Paper; 8 mf p/m 20%; 1000 WV	930 0150 00
C304		CAPACITOR: Not Used	
C305		CAPACITOR: Paper; .25 mf p/m 10%; 2000 WV	930 7220 00
C401	PA Plate blocking	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C402	PA Plate by-pass	CAPACITOR: Mica; 2200 mmf p/m 20%; 2500 WV	936 1083 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C403	Final tuning	CAPACITOR: Variable air dielectric; dual sect; 10-150 mmf per sect	920 0011 00
C403A	Part of C403	CAPACITOR: Section of C403	
C403B	Part of C403	CAPACITOR: Section of C403	
C404	Antenna network	CAPACITOR: Ceramic; 50 mmf p/m 10%; WV; 2500 Vrms at 2 mc. 1000 v rms at 16 mc	913 4503 20
C405	Antenna loading	CAPACITOR: Variable air-dielectric; single sect; 15-300 mmf	920 0014 00
C406	Antenna loading	CAPACITOR: Mica; 220 mmf p/m 10%; 2500 WV	936 0205 00
C407	Antenna loading	CAPACITOR: Mica; 470 mmf p/m 5%; 2500 WV	936 0226 00
C408	Antenna loading	CAPACITOR: Mica; 220 mmf p/m 10%; 2500 WV	936 0205 00
E304	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E305	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E306	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E307	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E308	Rear terminal strip	CONNECTOR: 14 term, barrier type strip w/lugs on back	367 0022 00
E309	Ground connector	POST, BINDING: Push type; 1/8" wire hole	372 1400 00
E313	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
E314	Sidetone and muting	TERMINAL STRIP: Bakelite; 2 terminals	367 0010 00
E401	Parasitic suppressor	CHOKE: 3T #20 wire; wound on 100 ohm 2 watt resistor	503 3452 002
F301	LV and filament	FUSE: 3 amp; 250 v	264 4080 00
F302	High voltage	FUSE: 5 amp; 250 v	264 4090 00
I301	Pilot lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
I302	Pilot lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
I303	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I304	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I305	Dial lamp	BULB: Pilot light; 6 v, .2 amp midget flange base; T1-3/4 bulb	262 0023 00
I306	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I307	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flang base; T1-3/4 bulb	262 0023 00
I308	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I309	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I310	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I311	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I312	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
J101	Key	JACK: Phone single circuit, midget	360 0008 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
J102	Cable	CONNECTOR: Std octal socket	220 1850 00
J201	Microphone	CONNECTOR: 2 female contacts; wall mtg	369 1004 00
J202	Modulator	CONNECTOR: Std octal socket	220 1850 00
J203	Sidetone power	CONNECTOR: Std octal socket	220 1850 00
J301	Antenna Connector	CONNECTOR: Single round female contact	357 9005 00
K301	Carrier control	RELAY: Circuit control; contacts 1A1B1A and 2A; 48 v coil	970 1014 00
L101	Osc. plate choke	COIL: RF choke; 4 pi; duo-lat wound; 2.5 mh p/m 20%; .125 amp	240 2100 00
L103	Buffer plate choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L104	1st Mult. Tuning	COIL: LF; 38T #28 wire	503 2896 002
L105	2nd Mult. Tuning	COIL: MF; 17.3T #28 wire	503 2895 002
L106	2nd Mult. Plate Choke	COIL: RF choke; 2 pi; duo-lat wound; 208 uh	240 6000 00
L107	3rd Mult. tuning	COIL: HF 7.6T #28 wire	503 2835 001
L108	3rd Mult. tuning	COIL: LF; 38T #28 wire	503 2896 002
L109	PA grid choke	COIL: RF choke; 4 pi; duo-lat wound; 2.5 mh p/m 20%; .125 amp	240 2100 00
L110	3rd Mult. tuning	COIL: 23T #26 wire	503 4512 001
L111	1st Mult. Plate Choke	COIL: RF choke; 3 pi; universal wound; 1 mh plus 20 minus 10%	240 0047 00
L112	3rd Mult. Plate Choke	COIL: RF choke; 3 pi; universal wound; 1 mh plus 20 minus 10%	240 0047 00
L201	Sidetone input filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L202	Sidetone output filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L203	Sidetone audio input r-f choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L204	Audio r-f filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L205		COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L206		COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L301	LV filter	REACTOR,FILTER: 11 hy p/m 15%	668 0012 00
L302	LV filter	REACTOR,FILTER: 11 hy p/m 15%	668 0012 00
L303	HV filter	REACTOR,FILTER: 5 hy p/m 15%	668 0055 00
L401	PA plate tuning	COIL: LF tank; 20T #14 wire	503 2892 002
L402	PA plate tuning (28 mc)	COIL: HF tank; 5T silver pl copper tubing	503 2831 001
L403	PA plate choke	COIL: RF choke; 5 pi; duo-lat wound; 3.5 mh p/m 10%	504 3667 003
L404	Network coil	COIL: Output; 32 turns; #18 wire	503 6486 001
M301	Mult. purpose	METER: 0-5 ma DC; 50 scale div; marked 0-250, 0-500, 0-1000	458 0110 00
M302	PA plate	METER: 0-500 mc DC; 50 scale div.	450 1500 00
P101	Osc. power	CONNECTOR: 4 prong plug; part of oscillator filter assem.	503 2868 002
P201	Microphone	CONNECTOR: 2 prong plug	369 1005 00
P301	Modulator power	CONNECTOR: Std 8 term octal plug	369 1009 00
P302	RF circuits power	CONNECTOR: Std 8 term octal plug	369 1009 00
P303	Sidetone power	CONNECTOR: Std 8 term octal plug	369 1009 00
P304		CONNECTOR: Single round male contact	357 9006 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R101		RESISTOR: Not used	
R102	Buffer grid	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R103	Buffer cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R104	Buffer screen	RESISTOR: .33 megohm p/m 10%; 1/2 w	745 1191 00
R105	V101, V102, V103 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R106	1st Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R107	1st Mult. cathode	RESISTOR: 820 ohm p/m 10%; 1/2 w	745 1083 00
R108	1st Mult. screen	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R109	1st Mult. plate decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R110	2nd Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R111	2nd Mult. screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R112	2nd Mult. plate decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R113	3rd Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R114	3rd Mult. screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R115	3rd Mult. plate decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R116	3rd Mult. plage decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R117	3rd Mult. grid stabilizer	RESISTOR: 10 ohm p/m 10%; 1/2 w	745 1002 00
R118	2nd Mult. cathode	RESISTOR: 1500 ohm p/m 10%; 1/2 w	745 1093 00
R119	PA grid meter shunt	RESISTOR: 6.2 ohm p/m 5%; 1/2 w	707 0104 00
R120	PA grid	RESISTOR: 3300 ohm p/m 10%; 1 w	745 3107 00
R121	3rd Mult. grid voltage divider	RESISTOR: .22 megohm p/m 10%; 1/2 w	745 1184 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R122	3rd Mult. grid return	RESISTOR: 680 ohm p/m 10%; 2 w	745 5079 00
R123	PA screen stabilizer	RESISTOR: 47 ohm p/m 10%; 1 w	745 3030 00
R124		RESISTOR: Not used	
R125	Dial light dropping	RESISTOR: 2 ohm p/m 10%; 2 w	710 1070 00
R126		RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R127		RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R201	Audio input r-f filter	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R202	V201 grid	RESISTOR: 1.0 megohm p/m 10%; 1/2 w	745 1212 00
R203		RESISTOR: Not used	
R204	V201 cathode	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R205	Audio gain control	RESISTOR: .5 megohm p/m 20%; 1/2 w	376 3027 00
R206	V201 plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R207	V201 plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R208	V201 plate decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R209	V201 plate decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R210	V202 grid	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R211	V202 cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R212	Sidetone plate	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R213	Sidetone plate	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R214	Sidetone grid	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R215	Sidetone grid	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R216	Audio decoupling	RESISTOR: 2200 ohm p/m 10%; 1 w	745 3100 00
R217	Sidetone pitch control	RESISTOR: .5 megohm p/m 20%; 1/2 w	376 3027 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R301	V105 screen dropping	RESISTOR: 12,000 ohm p/m 5%; 25 w	710 0366 00
R302		RESISTOR: Not used	
R303	Load stabilizing	RESISTOR: 7500 ohm p/m 10%; 25 w size	710 0069 00
R304	V105 screen bleeder	RESISTOR: 25,000 ohm p/m 10%; 25 w size	710 3254 20
R305	Mod. bias control	RESISTOR: Variable; ww; 1000 ohm ± 10%; 4 w	377 0007 00
R306	Bias bleeder	RESISTOR: 750 ohm p/m 5%; 10 w	710 1750 10
R307	LV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R308	LV meter shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R309	Relay voltage divider	RESISTOR: 5000 ohm p/m 10%; 10 w	710 1542 00
R310	Relay voltage divider	RESISTOR: 7500 ohm p/m 10%; 10 w	710 0033 00
R311	LV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R312	HV meter shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R313	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R314	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R315	Mod. shunt meter	RESISTOR: Wire wound; .51 ohm p/m 5%; 1/2 w	707 0026 00
R316	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R317	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R318	Mod ind. shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R319		RESISTOR: 2000 ohm p/m 10%; 10 w	710 1242 00
R320	Series Tuning	RESISTOR: Wire wound; 15 ohm p/m 10%; .25 w	710 3152 00
R321	Series Tuning	RESISTOR: Wire wound; 15 ohm p/m 10%; .25 w	710 3152 00
S101	Band change switch	SWITCH: 8 pole, 5 pos, 4 sect; non-shorting	503 2923 004

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S101A		SWITCH: Part of S101	
S101B		SWITCH: Part of S101	
S101C		SWITCH: Part of S101	
S101D		SWITCH: Part of S101	
S101E		SWITCH: Part of S101	
S101F		SWITCH: Part of S101	
S101G		SWITCH: Part of S101	
S101H		SWITCH: Part of S101	
S301	Cabinet lid interlock	SWITCH: SP normally open snap switch	260 0708 00
S302	Emission selector	SWITCH: Band change; 8 pole; 3 pos, 3 sect; non-shorting	259 0264 00
S302A		SWITCH: Part of S302	
S302B		SWITCH: Part of S302	
S302C		SWITCH: Part of S302	
S302D		SWITCH: Part of S302	
S302E		SWITCH: Part of S302	
S302F		SWITCH: Part of S302	
S302G		SWITCH: Part of S302	
S302H		SWITCH: Part of S302	
S303	High voltage switch	SWITCH: SPST toggle; 25 amp	266 1040 00
S304	Low voltage switch	SWITCH: SPST toggle; 25 amp	266 1040 00
S305	600-700 v selector	SWITCH: DPDT toggle; 1 amp 250 v, 3 amp 125 v	260 0892 00
S306	Meter selector	SWITCH: Band change; 2 pole, 5 pos, 1 sect; non-shorting	259 0045 00
S306A		SWITCH: Part of S306	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S306B		SWITCH: Part of S306	
S307		SWITCH: SPST toggle; 3 amp 250 v	260 0857 00
S401	PA plate circuit	SWITCH: Band change; 2 pole, 5 pos, 1 sect; shorting	259 0043 00
S401A		SWITCH: Part of S401	
S401B		SWITCH: Part of S401	
S402	Antenna loading	SWITCH: Band change; 6 position, shorting type	269 1248 00
T201	Modulator input	TRANSFORMER: Driver; pri; 12,000 ohm, sec: 5300 ohm CT, freq resp 300-3500 cps p/m 3 db	667 0011 00
T202	Modulation	TRANSFORMER: Mod; pri: 7000 ohm CT, 100 ma DC max, bal; sec: 500/3750 ohm, 200 ma DC, unbal; freq. resp 300/3500 cps p/m 3 db; 60 w	667 0010 00
T301	Low voltage	TRANSFORMER: Power; pri: 115 v, sec #1: 850 v CT; sec #2: 5 v, 4 amp; sec #3: 5 v, 4 amp; sec #4; 6.3 v, 9 amp 50/60 cps	662 0009 00
T302	High voltage	TRANSFORMER: Power; 50/60 cps; pri: 115 v; sec: 1100 v CT, w/pri leads #1 and #2 on 115 v, sec leads #4 and #6 should be 1370 v rms	662 0014 00
V101	Buffer amp.	TUBE: Type 6AK6; power amp pentode; miniature	254 0632 00
V102	1st multiplier	TUBE: Type 6AG7; video power amp pentode	254 0120 00
V103	2nd multiplier	TUBE: Type 7C5; beam power amp; octalox	254 0217 00
V104	3rd multiplier	TUBE: 7C5; beam power amp; octalox	254 0217 00
V105	Power amplifier	TUBE: Type RK-4D32; tetrode	256 0073 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
V106		TUBE: OA2 voltage regulator	257 0052 00
V107		TUBE: OB2 voltage regulator	257 0058 00
V201	1st and 2nd audio	TUBE: Type 6SL7GT; twin-triode amp	254 0187 00
V202	Audio driver	TUBE: Type 6SN7GT; twin-triode amp	254 0188 00
V203	Modulator	TUBE: Type 807, transmitting beam power amp	254 0391 00
V204	Modulator	TUBE: Type 807; transmitting beam power amp	254 0391 00
V205	Sidetone oscillator	TUBE: Type 6SL7GT; twin-triode amp	254 0187 00
V301	Low voltage rectifier	TUBE: Type 5Z4; full wave hi-vac rect	254 0110 00
V302	High voltage rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	254 0099 00
V303	High voltage rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	254 0099 00
V304	Bias voltage regulator	TUBE: Type OA3/VR-75; voltage regulator	257 0008 00
V305	Screen voltage limiter	TUBE: Type OA2; voltage limiter	257 0052 00
V306	Screen voltage limiter	TUBE: Type OA2; voltage limiter	257 0052 00
XV101	Socket for V101	SOCKET, TUBE: Miniature shielded	220 1003 00
XV102	Socket for V102	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV103	Socket for V103	SOCKET, TUBE: Loktal, bakelite	220 1002 00
XV104	Socket for V104	SOCKET, TUBE: Loktal, bakelite	220 1002 00
XV105	Socket for V105	SOCKET, TUBE: 7 prong ceramic w/clips	220 1072 00
XV106		SOCKET, TUBE: Miniature shielded	220 1003 00
XV107		SOCKET, TUBE: Miniature shielded	220 1003 00
XV201	Socket for V201	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV202	Socket for V202	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV203	Socket for V203	SOCKET, TUBE: 5 prong ceramic w/clips	220 5520 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XV204	Socket for V204	SOCKET, TUBE: 5 prong ceramic w/clips	220 5520 00
XV205	Socket for V205	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV301	Socket for V301	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV302	Socket for V302	SOCKET, TUBE: Octal ceramic w/clips and keyway	220 5810 00
XV303	Socket for V303	SOCKET, TUBE: Octal ceramic w/clips and keyway	220 5810 00
XV304	Socket for V304	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV305	Socket for V305	SOCKET, TUBE: Miniature, 7 term	220 1003 00
XV306	Socket for V306	SOCKET, TUBE: Miniature, 7 term	220 1003 00
XF301	Holder for F301	HOLDER, FUSE: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XF302	Holder for F302	HOLDER, FUSE: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XI301	Mtg for I301	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
XI302	Mtg for I302	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
	Jewel for I302	JEWEL: Pilot light; red faceted	262 2110 00

The 70E-8A oscillator used in this equipment has been dehydrated and hermetically sealed. If servicing is required it should be returned to the Collins Radio Company

COLLINS

32V-2
AMATEUR TRANSMITTER

INSTRUCTION BOOK

COLLINS RADIO COMPANY

32V-2 ADDENDA

February 1, 1950

After recognizing the high order of filtering that it was necessary to incorporate in an amateur transmitter operating in close proximity to television receivers, Collins engineers designed an output network to be used in the 32V-2 which should offer a great deal of attenuation to high order harmonics. In order to do this, it was necessary that an additional "L" section filter be added to the existing pi section. This new section contributes a great deal of filter action, but also offers some disadvantages. The first apparent difficulty noted is the apparent sharpness of tuning on the high frequency bands, particularly 28 mc. It must be recognized that this is inherent in any tuned filter where a high degree of selectivity is needed, and the fact that it does tune so sharply indicates that it is operating properly. Since the impedance across the L section inductance reaches fairly high values so does the voltage, and in certain cases, the addition of modulation to the carrier causes the output capacitor to arc across. It has been found that this voltage can be decreased to a point where this no longer occurs by lowering the inductance of the 28 mc portion of the L section inductor. The decrease in filter action by such a move is slight.

This modification, which is included in the 32V-2's (after serial #1325), is fortunately a simple one and can be readily accomplished by the customer. The task is to change the uppermost tap on L404 so that the inductance will consist of 8 turns from the top end of the coil instead of 11. An examination of this inductance will readily show that it is a simple task to move the lead that goes to the 11th turn from the top to the 8th.

Another source of difficulty that is occasionally encountered is the failure of the fixed ceramic loading capacitors in the pi section network. Unfortunately, the solution of this problem is not so simple and requires an understanding by the customer of the variables involved.

The pi section network was designed so that when used with the L section, a suitable range of impedances could be satisfactorily matched. The extreme cases were tabulated and the resulting voltages and currents were calculated. These voltages and currents were of such a magnitude as to not exceed the ratings of the components. However, when the customer connects the 32V-2 to an antenna system, frequently the standing waves are of such a nature as to reflect sufficient reactance so that the assigned endpoints of impedances are exceeded. This frequently results in an excess current thru the loading capacitors and subsequent failure.

However, when adequate precautions are taken, this problem can be greatly reduced. These precautions may be described simply by stating that they are directed in such a manner as to insure a flat 52 or 72 ohm line from the 32V-2 to the antenna tuner. The tuning procedure is as follows.

Disconnect the coaxial line from the antenna tuner link and terminate it in a non-inductive resistor whose value is the same as the Z_o of the coaxial line, and whose power rating is sufficient to dissipate 50 watts or so for prolonged periods. The transmitter should then be tuned and loaded to the proper point in the "tune" position. The unit should then be momentarily switched to the operate position to see that the final plate current reading is correct. In the event that non-inductive resistors are not available, it is possible to use a 100 watt lamp and obtain a SWR of about 1.5/1 on a 52 ohm line.

The coaxial line should then be connected through a series variable capacitor to the antenna tuner link of one turn on 10, 15 and 20 meters, two turns on 40 meters and three on 80 meters. The antenna tuner is resonated with the transmitter and the link reactance tuned out with the coaxial line series capacitor. The feeders should then be moved in equal increments out from the center, with the tuned circuit resonated, until the same loading condition exists that was noted with the dummy load. This will set up the desired condition where the transformation of impedance from the coaxial line is from 52 or 72 ohms to the antenna impedance. If this is done no standing waves will exist on the coaxial line and the loading capacitors will not be operated at excessively high values of current.

32V-2

AMATEUR TRANSMITTER

Manufactured by

COLLINS RADIO CO., CEDAR RAPIDS, IOWA

520 9465 00

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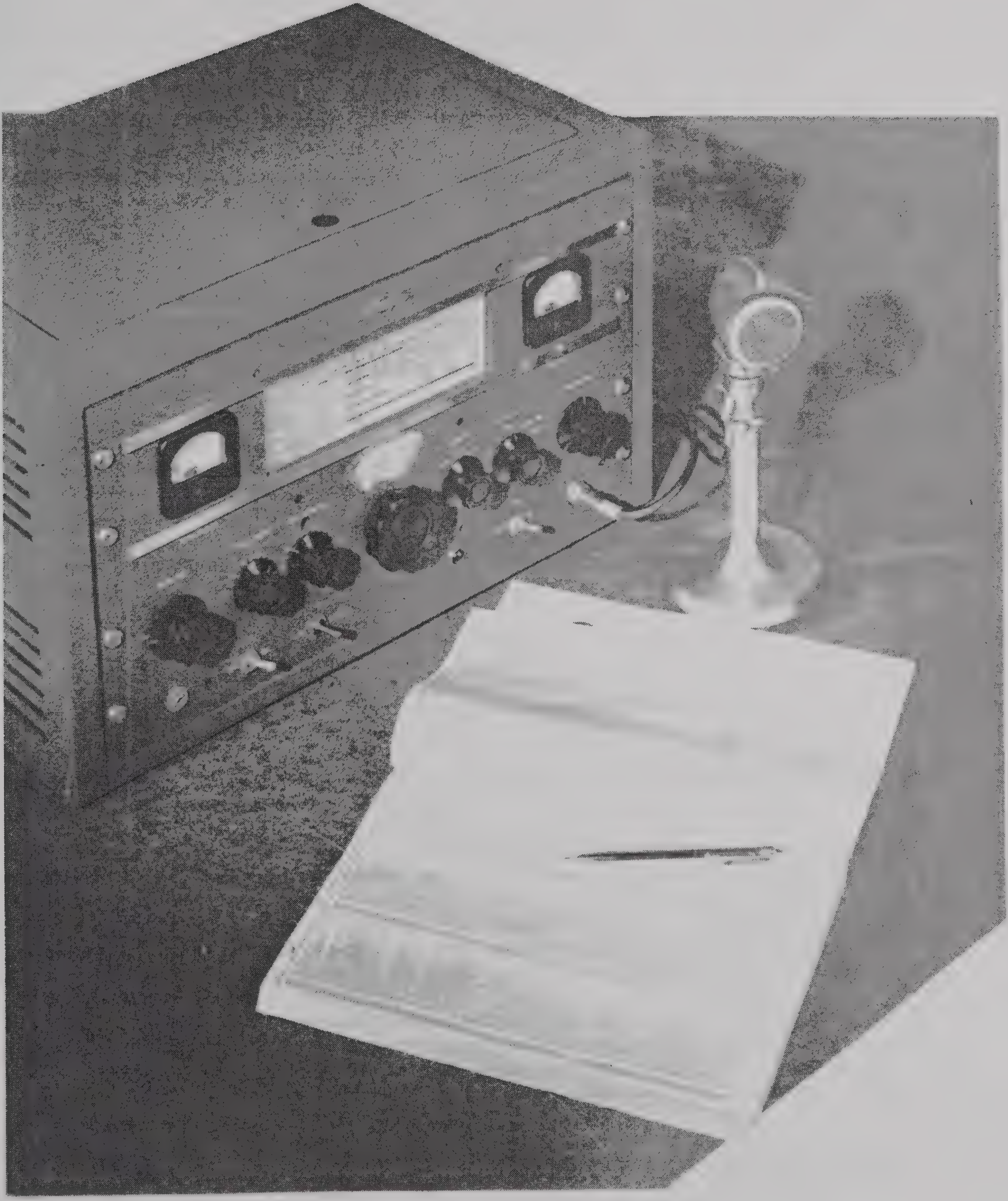


FIGURE 1-1 MODEL 32V AMATEUR TRANSMITTER

SECTION 1

GENERAL DESCRIPTION

1.1. GENERAL.

1.1.1. This instruction book has been prepared to assist in the proper installation, adjustment, operation and maintentenance of the Collins 32V-2 amateur transmitter.

The type 32V-2 is a transmitter designed for those amateurs who want medium power, bandswitching, and VFO control in a small cabinet. It may be used for either permanent or portable installations. All that is needed for putting it into operation is a 115 volt ac source, an antenna, and a key or microphone. The 32V-2 can also be used to drive a kilowatt final amplifier.

The 32V-2 transmitter is designed for table mounting. The complete transmitter is housed in a single cabinet 21-1/8" wide, 12-7/16" high and 13-7/8" deep and weighs approximately 105 lbs. Ventilating openings are provided in the back,two sides and bottom of the cabinet to assure adequate ventilation for all heat producing elements.

The components of the transmitter are so arranged that unit construction is possible and are broken down in five units as follows:

70E-8A Oscillator
R-F Unit
Output Network
Speech Amplifier and Modulator
Power Supply

All wiring is independent of the cabinet, and the complete unit may be removed from the cabinet for inspection or maintenance.

Complete coverage of the 80, 40, 20, 15, 11 and 10 meter bands is obtained with the 32V-2. Quick band-change is accomplished by bandswitching on all stages. The permeability tuned circuits of the 1st, 2nd and 3rd multipliers have their tuning controls ganged with the oscillator. The final tank consists of impedance matching network with two separate controls located on the front panel, one for tuning and one for loading.

Two heavy duty toggle switches control the low voltage and high voltage circuits. The switches are arranged so that the high voltage cannot be applied until the low voltage circuits have been energized. A push-to-talk switch, associated with the microphone, may be used to apply the high voltage instead of the HV toggle switch for added convenience.

A CW sidetone oscillator is incorporated in this unit with which CW transmissions can be monitored.

An additional feature, the receiver muting connection, can be used to silence a type 75A receiver during CW transmission for CW break-in operation.

A meter selector switch on the front panel enables the operator to meter all important circuits of the transmitter. This switch can be rotated to five different positions. Each position inserts a meter into the selected circuit to be metered. A separate meter reads FINAL AMPLIFIER plate current only. The CW-CAL-PH switch is used to select the type of emission desired and to calibrate the accuracy of the dial reading against a known standard frequency. In the CW position, the modulator is disabled, the master oscillator operates continuously with the HV switch on and the CW sidetone oscillator is connected to the audio amplifier stages. On "CAL" position a signal of strength suitable for zero-beating with incoming signals may be heard in the associated receiver without operating the final amplifier. On phone position, the key is closed and the modulator is operative. Keying is accomplished by means of grid block keying of the buffer stages. This keying is done on the buffer and first and second multiplier stages.

The AUDIO GAIN Control is used to control the level of modulation and the strength of CW sidetone output.

1.2. REFERENCE DATA.

Power Source: 115 volts ac 50/60 cps single phase.

Power Input Requirements: The maximum overall input power requirement is 500 watts at 90% power factor.

PA Plate Power Input: The nominal rated power input of the 32V-2 is 120 watts on phone and 150 watts CW.

Audio Distortion: Audio distortion is less than 8% at 90% modulation with a 1000 cps input frequency.

Frequency Response: Within 2 db from 200-3000 cps.

1.3. TUBE COMPLEMENT.

Quantity	Tube Type	Function
1	6SJ7	Oscillator
1	6AK6	Buffer Amplifier
1	6AG7	First Multiplier
1	7C5	Second Multiplier
1	7C5	Third Multiplier
1	4D32	RF Power Amplifier
1	6SL7	Audio Amplifier
1	6SN7	Audio Driver
2	807	Modulators
1	5Z4	LV Rectifier
2	5R4GY	HV Rectifier
1	VR-75	Bias Regulator
1	6SL7GT	CW Sidetone Oscillator
2	OA2	Screen voltage limiters

SECTION 2

INSTALLATION

2.1. UNPACKING.

After the unit has been removed from the packing box, inspect the unit for loose screws or bolts. Be certain all controls, such as switches, dials, etc. work properly. In case of damage, file all claims promptly with the transportation company. If a claim for damage is to be filed, the original packing case and material must be preserved. Check all tubes to see that they are fully in their sockets. See figure 2-1 for tube placement.

2.2. PLACING TRANSMITTER.

The console type cabinet is designed to be placed on the operating table along with the receiving equipment. Allow enough space at the rear for making the necessary external connections and for replacement of fuses. Sufficient clearance at the sides should be provided for full circulation of air.

2.3. EXTERNAL CONNECTIONS.

Place the two power switches in the off position before attempting to make any external connections. The external connections are as follows:

(1) AC Power Line
(2) Microphone and Key
(3) Radiation System
(4) Remote Relay
(5) Receiver Disabling Circuit
(6) CW Sidetone
(7) Receiver Muting

2.3.1. POWER LINE. - The 32V-2 operates from a 115 volt, single phase, 50/60 cycle power source. The supply line should be checked for these specifications. The maximum power required from the line is 500 watts. Insert the 115 volt plug into a convenient standard outlet.

2.3.2. MICROPHONE AND KEY. - The microphone plug is inserted in the microphone jack J201 on the front of the transmitter. Make sure the clamping ring on the microphone plug is tightly turned on the thread around the input receptacle. Push-to-talk control connections are made to pin number 2 to ground in the microphone plug where the microphone being used is equipped with a push-to-talk switch. When using a microphone that does not have such a switch, the transmitter can still be controlled from a remote position by running a pair of leads from terminal 11 and 12 on the rear terminal strip (E308) to a switch box located at some point convenient to the operator.

CAUTION

Do not get the microphone and push-to-talk connections reversed when assembling the microphone plug since the relay voltage present could damage certain types of microphones.

The telegraph key is plugged into the key jack, J101, on the front panel.

2.3.3. RECEIVER DISABLING CIRCUIT. - Terminals 13 and 14 on the rear terminal strip (E308) are connected to normally closed contacts on the carrier control relay and are to be used for connections to the receiver disabling circuit. Remove the jumper on the receiver terminals and connect terminals 13 and 14 to these two terminals. The receiver can then be made inoperative when the push-to-talk switch is pressed or whenever the HV switch is operated.

2.3.4. REMOTE RELAY CONNECTIONS. - Terminals 7,8,9 and 10 on the rear terminal strip may be used for operating an antenna change-over relay or a relay for turning on the plate power of a power amplifier stage when the 32V-2 is used as an exciter. If a 115 volt ac type relay is used, connect the leads from the relay coil to terminals 7 and 10. In this manner, the relay coil will be energized thru contacts 8 and 9 of relay K301 whenever the push-to-talk switch or HV switch is operated. If a dc type of relay is used, remove the jumper from terminals 8 and 9 and use terminals 9 and 10 to control the operations of the remote relay thru the contacts of the transmitter relay.

> CAUTION.- Do not use the RECEIVER DISABLING CIRCUIT AND REMOTE RELAY CONNECTIONS for conducting large currents, as damage to the relay contacts may result.
>
> CAUTION. - For safety reasons, remove the 115 volt plug from the AC power outlet while making connections to the rear terminal strip.

Switch pi S101H, located at the rear of the band switch, can be used to automatically operate antenna selector relays, etc., as the band switch is turned. Connections to this switch section will have to enter the cabinet through a ventilation slot at the side of the cabinet.

2.3.5 CW SIDETONE. - Any 500 ohm or higher impedance headphone or 500 to 1000 ohm speaker can be connected between terminals 16 and 12 (gnd) at the rear of the unit for sidetone output. The sidetone will be operative when the EMISSION switch is in the CW position. Sidetone pitch is controlled from within the top door while the volume is controlled by the AUDIO GAIN control.

2.3.6. RECEIVER MUTING. - If a Collins Model 75A receiver is used for receiving, CW break-in operation can be improved by connecting terminal B on the receiver to terminal 15 on the 32V and terminal G to terminal 12 (gnd). This connection mutes the receiver audio when the key is pressed and the receiver NOISE LIMITER switch is in the IN position. For CALIBRATION, the receiver limiter switch should be in the OUT position.

2.3.7. RADIATION SYSTEM.-The output network will match impedcance of 26 to 300 ohms on all bands. It will tune out inductive or capacitive reactances normally encountered. The output network is unbalanced with respect to ground and may be used to feed directly into unbalanced systems. Connection to the antenna transmission line is made by means of a PL-259 52 ohm coaxial connector. Do not end feed antennas which are multiples of 1/2 wave in length directly from the antenna terminals; rather, use an external antenna tuner. Random length antennas must not fall on exact odd multiples of 1/4 wave-length long but should be 10 to 20% longer or shorter. A Type 315E-1 Balun Transformer (not supplied) may be used to feed a balanced antenna system.

2.3.8. EXTERNAL ANTENNA TUNE. (Not Available)

To feed balanced transmission lines, tuned or untuned, couple the transmitter to the transmission line with a simple tuned circuit illustrated below.

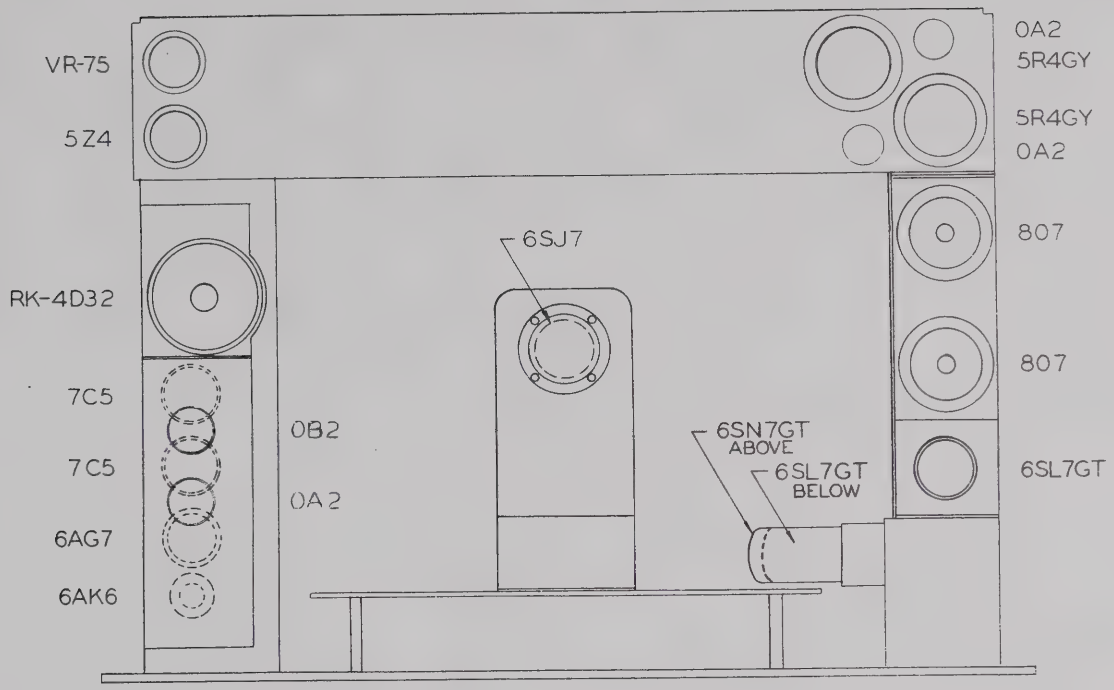
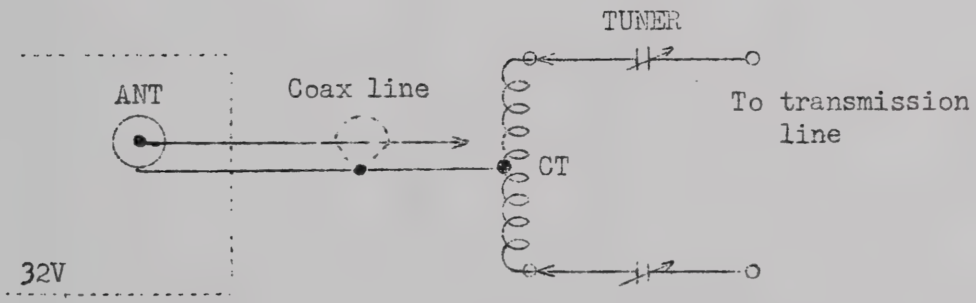
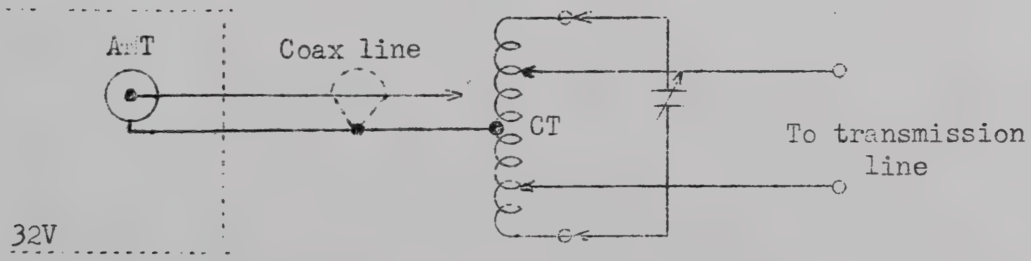


Figure 2-1 Tube Placement Diagram



SERIES TUNING



PARALLEL TUNING

Figure 2-2 Typical Antenna Tuner

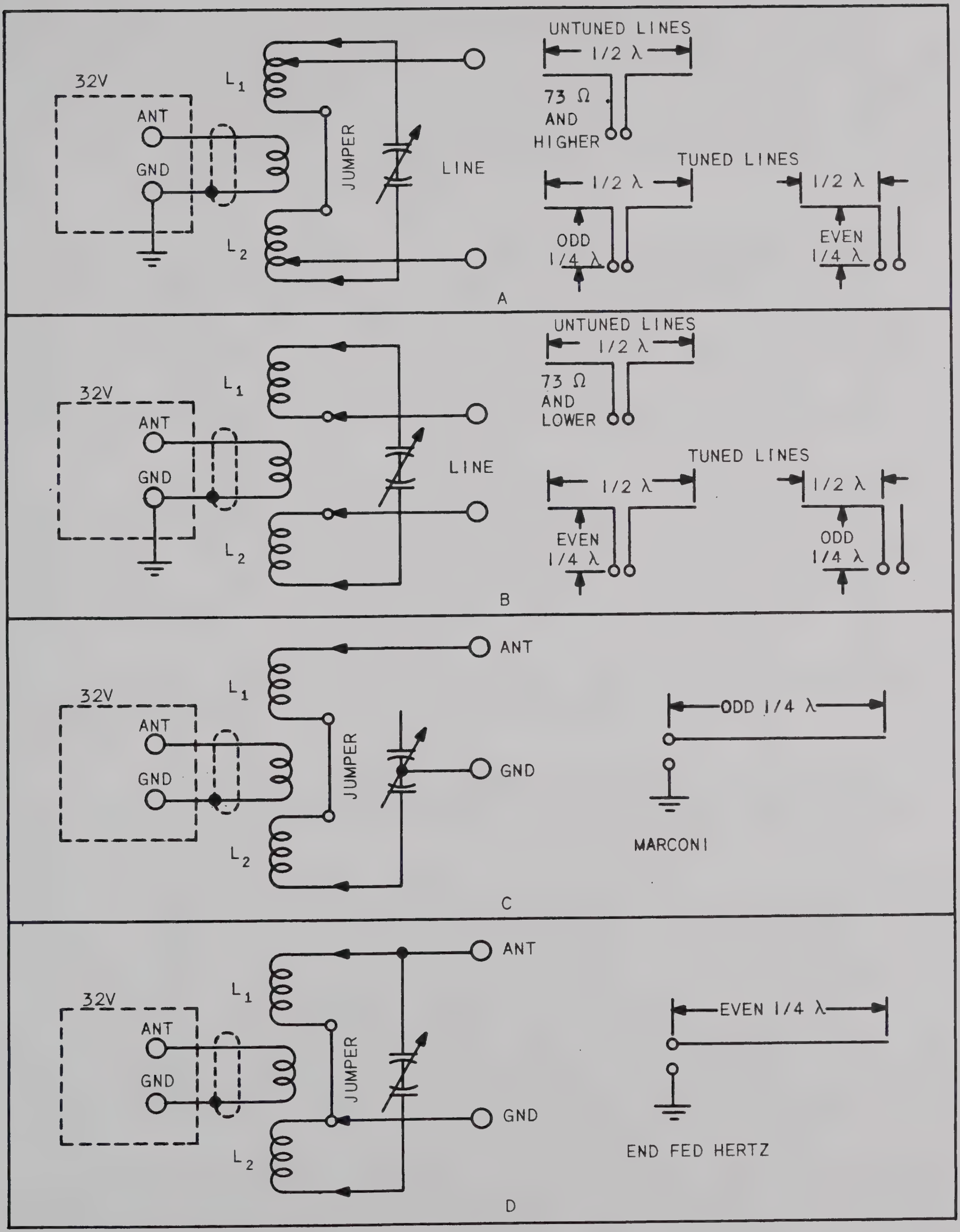


Figure 2-3 Typical Antenna Tuner Circuits

This arrangement will match a wide range of impedances. It will also add further attenuation to harmonics causing TVI, providing it is completely shielded. Figure 2-2 illustrates an antenna tuner which will function satisfactorily in this application. The impedance of the transmission line is matched by choosing proper taps on the inductances L1 and L2. The coupling link is coupled as tightly as possible and all loading adjustments are done with the LOADING control on the 32V-2. On the 15, 11, and 10 meter bands, the number of turns in the coupling coil should not exceed one turn; two turns may be necessary on the 20 meter band.

a. UNTUNED HIGH IMPEDANCE TRANSMISSION LINE. - If the line has a characteristic impedance of 73 ohms or more, parallel tuning of the antenna coils L1 and L2 should be employed. For parallel tuning, the little jumper seen above the antenna coils should be closed. The transmission line taps should be set on the same turns as the capacitor taps to start with, then varied towards the center of the coils until proper loading is obtained. The transmission line taps are those at the top of the coils while the capacitor taps are those nearer the bottom. In this type of operation, low values of capacitance and high values of inductance for the operating frequency generally are best. See illustration A., figure 2-3.

b. UNTUNED LOW IMPEDANCE TRANSMISSION LINES. - Transmission lines having a characteristic impedance of less than 50 ohms require series tuning of the antenna coils. This is done by opening the small jumper above the coils and moving the transmission line tap arms to the inside coil turns. The capacitor taps should be set at the outside turns ana varies towards the inside turns until proper loading is obtained. Higher values of tuning capacity usually work out best in this type of operation. See illustration B., figure 2-3.

c. VOLTAGE FED TUNED LINES. - Transmission lines which have a high voltage point at the transmitter should be connected and tuned identically with instructions given in a. above. It is recommended that tuned lines be cut to multiples of a quarter wave in length.

d. CURRENT FED TUNED LINES. - Transmission lines having high current at the transmitter end should be connected and tuned identically with instructions given in b. above. These lines should also be cut to exact multiples of a quarter wave in length.

e. **QUARTER WAVE MARCONI.** - Series tuning is indicated for quarter wave Marconi antennas, In this type of operation, the antenna tuning circuit should be connected so that the two sections of the antenna coil and one half of the antenna tuning capacitor are in series. To do this, place a grounding jumper to the rotor of the antenna tuning capacitor, connect the antenna to one end of the antenna coil, connect one stator of the tuning capacitor to the other end of the antenna coil and disconnect the other stator completely. (Place a piece of insulation material between the tap rotor and the coil turns.) See illustration C., figure 2-3. In event r-f voltage appears on the cabinet, it can be minimized by extending the ground wire to 1/2 wave length and series tuning it until resonance is obtained.

f. END FED HALF WAVE. - This tuner can be used to tune this type of antenna also. Parallel tuning should be employed for this type operation. The antenna should be connected to one end of the antenna coil, a ground connection should be made to the inside turn of one of the antenna coils and the little jumper on top of the coils should be closed. The tuning capacitor taps should be equally spaced from each end of the antenna coils for proper tuning at the operating frequency. See illustration D., figure 2-3.

SECTION 3

ADJUSTMENT AND OPERATION

3.1. ADJUSTMENT.

3.1.1. 600 v - 700 v SWITCH. - This switch, located in the primary of the power transformer, has been placed at the rear of the transmitter to select output voltages of either 600 or 700 volts. It is recommended that this switch be placed in the 600 volt position for initial adjustments.

3.1.2. CALIBRATION. - To check dial calibration, proceed as follows:

(a) Turn the equipment ON as outlined in steps (a) and (b) paragraph 3.2.3.

(b) Tune a communications receiver to WWV at 10 mc. The BFO in the receiver should be OFF.

(c) Rotate the BAND switch to 80 meter band. (lowest scale)

(d) Rotate the TUNING dial to 4.0 mc.

(e) Rotate the CW-CAL-PH control to CAL. This turns the VFO, buffer, first and second multiplier stages ON so that a calibration signal can be heard. Close the telegraph key.

(f) Continue to rotate the TUNING dial about 4.0 mc until the calibration signal is zero beat with WWV.

(g) Turn the FIDUCIAL screw until the hair line is on 4.0 mc.

(h) In like manner, the dial can be calibrated on 15,000 kc by setting the communications receiver at WWV on 15 mc and the 32V-2 TUNING dial at 15 mc on the 20M BAND position. See the following table.

WWV Frequency	Dial Setting	Oscillator Frequency	Oscillator Harmonic
10 mc	4,000	2,000	5th
15 mc	15,000	1,875	8th
15 mc	7,500	1,875	8th

3.2. OPERATION.

3.2.1. GENERAL. - The operation of this equipment is exceedingly simple once the functions of the controls are understood. The function of the controls is hereby given, followed by a step-by-step procedure for operating the equipment.

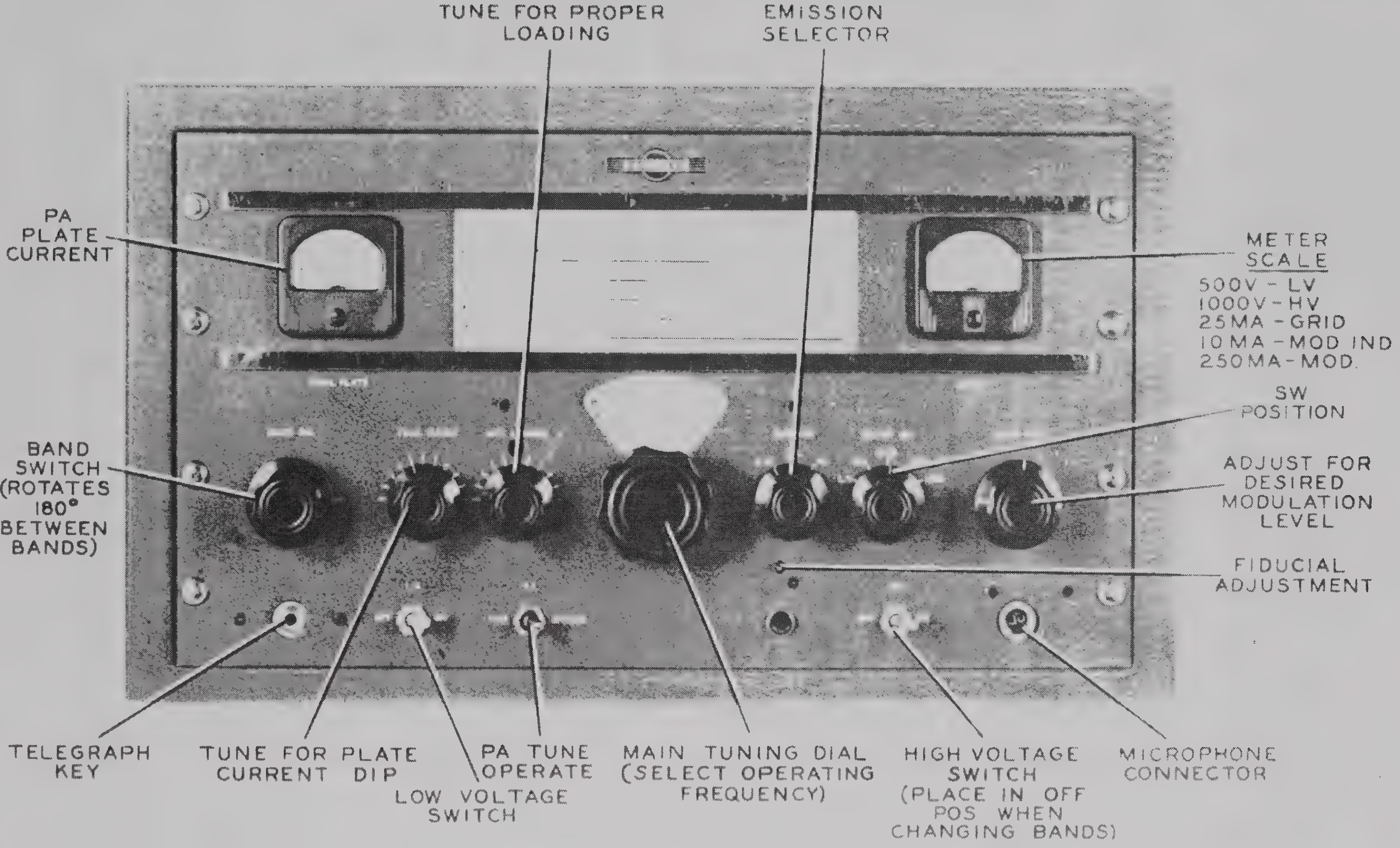


FIGURE 3-1 32V-2 CONTROL FUNCTIONS

3.2.2. FUNCTION OF CONTROLS.

(a) BAND SWITCH. - This control selects the proper tuning elements in all stages for the amateur band upon which operation is desired. The knob rotates 180 degrees between adjacent bands. Clockwise rotation selects higher frequency bands. The band selected is indicated by the band lighted slide rule dial.

(b) TUNING Control. - This control operates both the slide rule dial and the vernier dial to select the exact frequency upon which operation is desired.

(c) CW-CAL-PH Switch. - This three position switch selects the type of emission required. In the CW position, the secondary of the modulation transformer is short circuited, the screen voltage is removed from the modulator tubes, a bleeder is placed between the PA screen grid to ground and the carrier-control relay is connected so that it can be operated by the HV switch. The transmitter is ready for CW operation when the key is inserted in the KEY jack. In the CAL position, the VFO, buffer, first and second multiplier stages are in operation to supply a signal of suitable strength for zero-beating against received signals without causing interference to other stations. The carrier control relay is disconnected from the HV switch so that the associated receiver and antenna changeover relay will be in the "Receive" condition. In the PH position, the switch opens the short circuit on the secondary of the modulation transformer, closes the keying circuit, applies screen voltage to the modulator tubes and connects the carrier control relay so that it can be operated by the HV switch or a push-to-talk switch on a microphone.

(d) METER Switch. - The METER switch selects various circuits to be metered by the meter directly above the switch. This meter has 3 scales: 0-250; 0-500 and 0-1000. The table below indicates how it is used:

METER SWITCH POSITION	CIRCUIT METERED	FULL SCALE DEFLECTION READS
LV	Low voltage	500 volts
HV	High voltage	1000 volts
GRID	PA grid current (DC)	25 ma
MOD IND	Mod. grid current	10 ma
MOD	Mod. plate current	250 ma

The meter on the left reads PA Plate current only. Full scale deflection reads 500 ma.

(e) AUDIO GAIN. - This control adjusts the level of modulation in phone operation and the volume of the sidetone signal in CW operation.

(f) LV Switch. - The LV switch turns the filaments and the low voltage plate and bias supply on. (Plate voltage is not applied to the r-f exciter tubes; however, until the HV switch is turned on, except when the CW-CAL-PH switch is on CAL position.)

(g) HV Switch - The HV switch turns on the high voltage supply and connects plate voltage to the r-f exciter tube thru operation of carrier control relay K301. The push-to-talk connections are in parallel with this switch.

(h) FINAL TUNING. - This control is used to obtain resonance of the PA plate circuit. It must be reset after each adjustment of the ANT. LOADING controls.

(i) ANT. LOADING. - This control is used to obtain correct antenna tuning and loading. Start with this control in position number 1. Usually the 80 meter band will load up on positions 1, 2, or 3, the 40 meter band on 4, the 20 meter band on 5, the 15 meter band on 6, and the 10 and 11 meter bands on position 6 of the loading control.

(j) TUNE-OPERATE SWITCH. - This switch inserts some resistance in the primary of the power transformer in the TUNE position to reduce plate voltage during the tuning procedure. This switch should always be used to protect the power amplifier tube in off resonance conditions.

(k) FIDUCIAL. - This control, a small screwdriver adjustment located directly under the CW-CAL-PH knob, is used to move the vernier dial index during calibration adjustments. Once it has been set, further adjustment will be unnecessary over long periods of time.

(l) 600 - 700 v SWITCH. - This switch, located at the rear of the chassis, is used to select either 600 of 700 volts (approx.) for application to the PA plate.

(m) SIDETONE PITCH. - The sidetone pitch control is located within the cabinet near the modulator tubes. This adjustment should be set at the position which produces the most desirable tone according to individual taste.

3.2.3. OPERATION PROCEDURE.

(a) Operate the LV switch to the ON position. Allow two minutes for the tubes to heat.

(b) Turn the AUDIO GAIN to the counterclockwise stop. (off)

(c) Turn the ANT. LOADING control to position 1. (minimum loading)

(d) Place the CW-CAL-PH control in the position indicating the desired emission.

(e) Rotate the BAND switch to the band containing the desired operating frequency.

(f) Rotate the TUNING dial to the desired frequency.

(g) Place the Meter selector switch in the GRID position and close the telegraph key. (If PH emission was selected, it will not be necessary to close the key.)

(h) Place the TUNE-OPERATE switch in the TUNE position.

(i) Observing the FINAL PLATE meter, turn the HV switch ON and quickly turn the FINAL TUNING to resonance, i.e. minimum plate current dip.

(j) Observe the GRID current reading on the right hand meter. This should be between 5 and 15 ma.

(k) Operate the ANT. LOADING control clockwise until approximately 125 ma loading is obtained while keeping FINAL TUNING at resonance. Repeat this procedure until 125 ma reading is obtained with complete resonance of PA. If it is impossible to load to 125 ma PA plate current, rotate the ANT. LOADING control clockwise until proper loading is obtainable.

(l) Place the TUNE-OPERATE switch in the OPERATE position and load the PA to 180 ma with the ANT. LOADING control maintaining resonance with the FINAL TUNING control.

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Observe all safety regulations. Do not change tubes or make adjustments inside equipment with the high voltage supply ON. Do not depend upon door interlocks for protection but always turn the high voltage supply OFF. SWITCH TO SAFETY.

(m) If CW emission was selected, the telegraph key can be opened and the transmitter keyed. If PH (phone) emission is selected, turn the METER switch to MOD. and observe the static (resting) modulator plate current. This should be about 50 ma for the 600 v position of the 600 - 700 v switch at rear (55 ma on the 700 v position). Advance the AUDIO GAIN control while speaking in normal tones into the microphone until the modulator plate current swings to about 100 ma on peaks. This will result in approximately 100% modulation with voice input. If desired, a more exact check of modulation level can be made with an oscilloscope while observing the proper meter swing for the voice of the individual operator.

With sine wave input, the modulator plate current will read about 200 ma for 100% modulation.

With the METER switch set to MOD. IND., a slight kick of the needle indicates approximately 100% modulation on voice peaks. This is useful as an alternate method of indicating modulation level, since no deflection occurs on the meter until the modulation level reaches approximately 55%. The level at which the meter kicks depends somewhat upon the loading of the final amplifier and characteristics of the modulator tubes.

NOTE

In step (g) above, the key plug can be pulled from the key jack since this is a closed circuit type jack.

CAUTION

When changing BANDS, place the HV switch in the OFF position. Also place the PUSH-TO-TALK switch in the OFF position.

NOTE

If the 600 - 700 v switch is placed in the 700 v position, the PA plate current should be 220 ma.

3.2.4. TYPICAL METER READINGS. (PH position without modulation.)

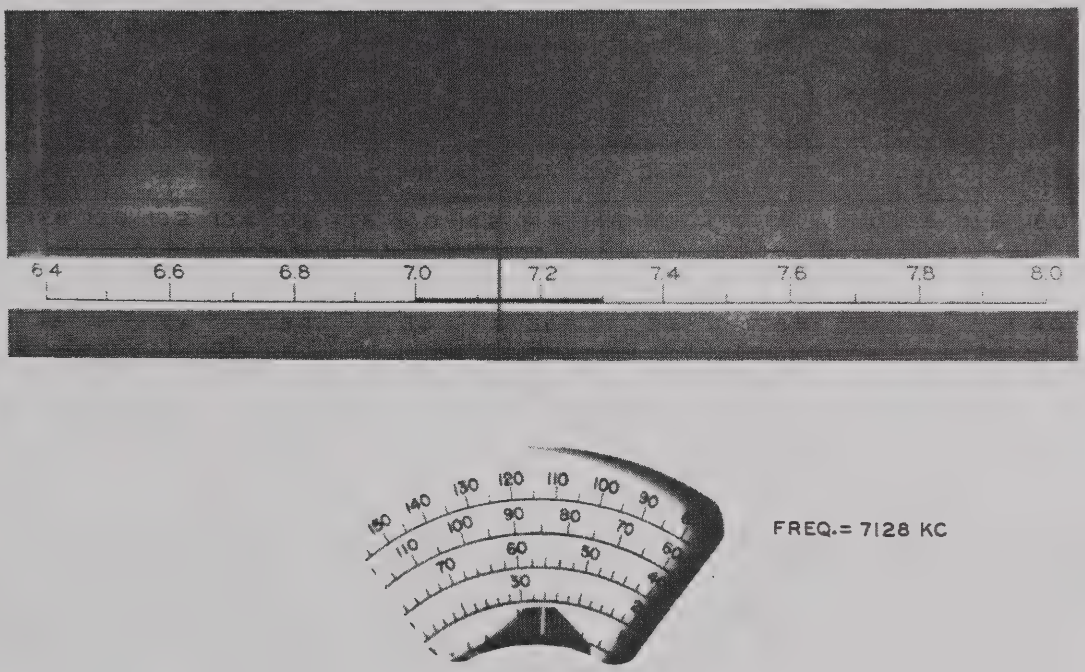
	LV	HV	GRID	MOD	FINAL PLATE BOTH PHONE & CW
600 v	240	580	10	50	180
700 v	240	720	10	55	220

3.2.5 DIAL CALIBRATION. - When changing BANDS, the proper scale on the slide rule dial is illuminated automatically as the BAND switch is rotated. At the same time, the vernier dial fiducial moves up or down the vernier dial face and stops at the corresponding scale to which the slide rule dial is positioned.

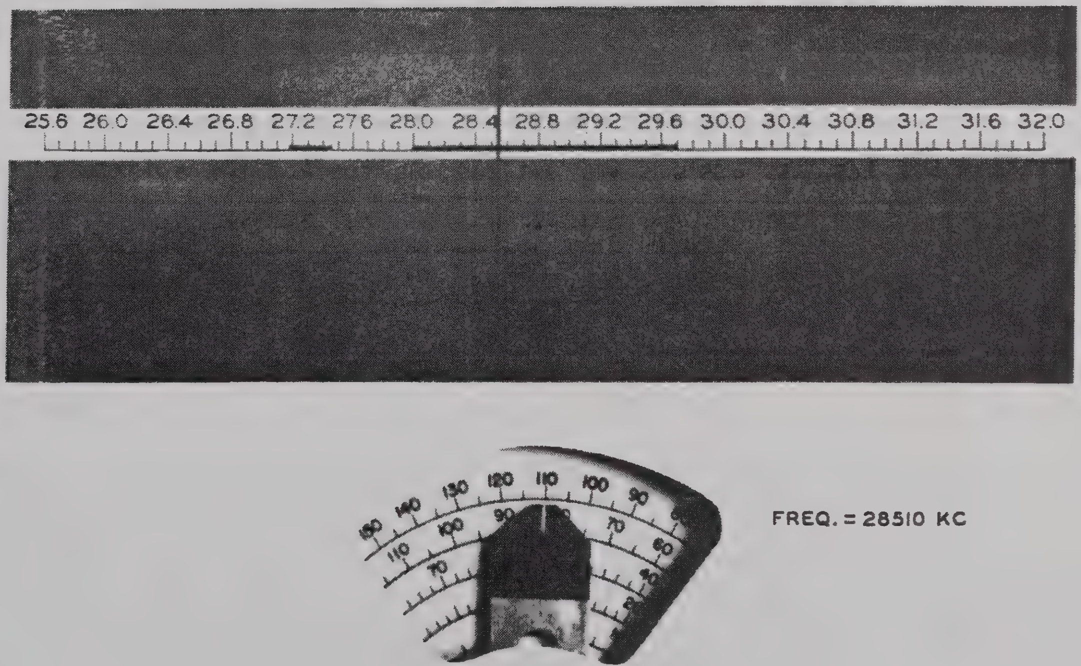
The dial is read by combining the vernier dial reading with the slide rule dial reading. The exact method varies somewhat from the low frequency bands to the high frequency bands and can best be learned by referring to figure 3-2.

3.2.6. ANTENNA LOADING TABLE. - This table indicates the approximate position for the antenna loading control for loading into various antenna impedances on the different bands.

POSITION OF ANT. LOADING CONTROL (for resistive loads)				
FREQ MC	26 ohm LOAD	50 ohm LOAD	100 ohm LOAD	300 ohm LOAD
3.5	2	2	2	2
4.0	3	3	3	4
7.0	4	4	4	4
7.3	4	4	4	4
14.0	5	5	5	5
14.4	5	5	5	5
21.0	6	6	6	6
21.45	6	6	6	6
27.2	6	6	6	6
28.0	6	6	6	6
29.7	6	6	6	6



FREQ.= 7128 KC



FREQ. = 28510 KC

FIGURE 3-2 TYPICAL DIAL READINGS

SECTION 4

CIRCUIT DESCRIPTION

4.1. GENERAL. - The following paragraphs have been written to enable the owner of a 32V-2 to understand the functioning of his transmitter more fully. This section should be read and understood before any extensive servicing is attempted.

4.2. CIRCUIT DESCRIPTION.

4.2.1. RF CIRCUITS.

(a) OSCILLATOR - A type 6SJ7 tube is employed in a highly stabilized master oscillator circuit to generate the controlling radio frequency voltage. This frequency generating unit is a linearly - tuning permeability tuned oscillator with a range of 1.6 to 2 megacycles. Sixteen turns of the main tuning dial cover this range. This provides 50 KC per revolution of the second harmonic (3.2 to 4 mc band). With the end points properly set up, the tuning curve is linear within one dial division of the ideal tuning curve on any of the bands in the operating range. The oscillator circuit is compensated for temperature changes and is entirely enclosed in a heavy aluminum case.

(b) INTERMEDIATE STAGES. - Following the master oscillator, a type 6AK6 is employed in an untuned, Class A amplifier stage. This stage completely isolates the master oscillator from the remaining tuned stages. The 6AK6 drives a series of three frequency multiplier tubes, the first of which is a type 6AG7. The operating frequencies at the plate of the multiplier tubes for the different bands is given in the following table:

	1ST MULT. 6AG7	2ND MULT. 7C5	3RD MULT. 7C5
80M	3.5 mc	3.5 mc	3.5 mc
40M	3.5 mc	3.5 mc	7 mc
20M	3.5 mc	7 mc	14 mc
15M	5.75 mc	10.5 mc	21 mc
11M	6.8 mc	13.6 mc	27 mc
10M	7 mc	14 mc	28 mc

Plate screen and filament power for these stages is obtained from the low voltage power supply. Gang tuning of the multiplier stages is obtained by moving powdered iron cores, attached to a common platform, in and out of the plate coils which are wound to give linear tuning. This platform to which the iron cores are attached is also ganged to the master oscillator tuning for complete, single control tuning of the exciter stages. Band switching is accomplished by adding extra padding capacity across coils by means of the band switch in all cases excepting the 14 mc output of the third multiplier where an inductance is switched in in parallel with the existing 40 meter inductor to lower the tuning inductance for 14 mc output.

(c) POWER AMPLIFIER STAGE. - A type 4D32 tetrode power amplifier tube is used in the PA stage. This tube always operates as a straight amplifier. The plate circuit is tuned by a combination pi-network and "L" network which is band-switched along with the multiplier stages. The combination network reduces the output impedance to around 50 ohms on all bands by means of inductance and capacitance switching. The output network will actually operate satisfactorily with antenna impedances in the range 26 to 600 ohms. It is also effective in reducing harmonic output of the transmitter. The screen grid and plate of the 4D32 are both modulated in phone transmission. Plate and screen voltage is obtained from the high voltage supply while filament power is obtained from the low voltage plate supply transformer. The tube is biased with 75 volts of fixed-bias plus some grid leak bias.

4.2.2. AUDIO CIRCUITS. - The first and second audio amplifier consists of a type 6SL7 tube operated as a cascade amplifier. A volume control, R205, is located in the grid circuit of the second amplifier stage. The driver stage employs a type 6SN7 tube with the two triode sections operated in parallel to drive the modulator stage. The modulator stage utilizes a pair of type 807 tubes connected in a push pull circuit and operating class AB_2. The output of the modulator is coupled to the final amplifier by transformer, T202, to modulate the plate and screen of that stage. During CW operation, the secondary of the modulation transformer is shorted out by S302A. Bias for the modulator tubes is adjustable by R305, and obtained from the low voltage supply and regulated by the voltage regulator tube, V304, type VR-75. The secondary of the modulation transformer has a 500 ohm tap provided for supplying 60 watts of audio power to an external load.

4.2.3. HIGH VOLTAGE SUPPLY. - The high voltage transformer is energized when the contacts of relay, K301, are closed. The high voltage supply employs two type 5R4GY rectifier tubes connected in parallel in a full wave circuit. The output is filtered by a single section choke input filter. This supply furnishes voltage for the plate and screen of the final amplifier and plate voltage for the modulator tubes. The amount of output voltage from this supply may be either 600 volts or 700 volts depending on the position of the tap switch, S305, in the primary winding of the high voltage transformer, T302. For the same power input, the efficiency of the final amplifier improves with the higher operating voltage. The tube manufacturer recommends no more than 600 plate volts for phone operation, but this is for CCS rating. A pair of 15 ohm resistors are connected in series with the HV plate transformer primary for "tune-up". These are shorted out when operating.

4.2.4. LOW VOLTAGE SUPPLY. - Transformer, T301 furnishes power for both the low voltage plate supply and the filament of all tubes in the transmitter. T301 is energized by closing the LV switch, S304. Three separate windings on transformer, T301, furnishes filament power to the tubes. The low voltage plate supply employs a type 5Z4 rectifier tube in a full wave circuit with a two section choke input filter. This supply has a total output voltage of approximately 315 volts, 240 volts is supplied to the audio amplifier, oscillator, buffer and multiplier stages. Bias voltage for the modulator and final amplifier stage is furnished by this supply. It also supplies voltage for the operation of relay, K301.

4.2.5. RECEIVER MUTING CIRCUIT. - Users of the Collins Model 75A receiver can take advantage of the cw muting circuit contained therein. This muting is accomplished by blocking the noise limiter circuit in the receiver with a positive voltage. In the 32V-2 transmitter this positive voltage is obtained from the voltage drop across the cathode resistor of the second multiplier tube, V103. The receiver limiter switch should be in the OUT position during CALIBRATION adjustments of the 32V-2 and in the IN position when muting is desired on CW operation.

SECTION 5

MAINTENANCE

5.1. INSPECTION.

5.1.1. GENERAL. - This radio equipment has been constructed of materials considered to be the best obtainable for the purpose and has been carefully inspected and adjusted at the factory to reduce maintenance to a minimum. However, a certain amount of checking and servicing will be necessary to maintain efficient and dependable operation. The following section has been written to aid in checking the equipment.

5.1.2. ROUTINE INSPECTION. - Routine inspection schedules should be set up for periodic checks of this equipment. This inspection should include examination of the mechanical system for excessive wear or binding and of the electrical system for electrical defects and deterioration of components.

If the routine inspection of the equipment is carried out faithfully, the chances of improper operation of the equipment are greatly minimized. It is suggested that this inspection be made as frequently as possible and it should be sufficiently thorough to include all major electrical circuits of the equipment as well as the mechanical portion.

(a) CLEANING. - The greatest enemy to uninterrupted service in equipment of this type is corrosion and dirt. Corrosion, itself, is accelerated by the presence of dust and moisture on the component parts of the assembly. It is impossible to keep moisture out of the equipment in certain localities, but foreign particles and dust can be periodically removed by means of a soft brush and a dry, oil-free jet of air. Remove the dust as often as a perceptible quantity acculululates in any part of the equipment. It is very important that rotating equipment, such as variable condensers and tap switches, be kept free from dust to prevent undue wear. Likewise, variable condenser plates should be kept free from dirt to avoid flashover.

One of the greatest sources of trouble in equipment located in a salt atmosphere is corrosion. Corrosion resulting from salt spray or salt laden atmosphere may cause failure of the equipment for no apparent reason. In general, it will be found that contacts such as tap switches, tube prongs, cable plug connectors, and relay contacts are most affected by corrosion. When it is necessary to operate the equipment in localities subject to such corrosive atmosphere, inspection of wiping contacts, cable plugs, relays, etc., should be made more frequently in order to keep the equipment in good condition.

(b) VACUUM TUBES. - Make a check of emission characteristics of all tubes. After the emission check, examine the prongs on all tubes to make sure that they are free from corrosion. See that all tubes are replaced correctly and fully in their sockets, and a good electrical contact is made between the prong of the tube and the socket. Use caution in removing and replacing grid or plate caps on tubes so equipped. Before a tube is discarded, make certain that the tube is at fault and the trouble is not a loose or broken connection within the equipment. A complete set of tested tubes of the same type specified should be kept on hand at all times. If faulty operation of the transmitter is observed and tube failure suspected, each tube may be checked by replacing it with a tube known to be in good condition. Defective tubes causing an overload in power circuits may usually be located by inspection. It will be found that excessive heating or sputtering within the vacuum tubes is a good indication of a fault in the tube circuit.

If tubes have been in use for a period of time equal to or exceeding the manufacurer's tube life rating, it is suggested that they be replaced. A marked improvement in the performance of the equipment is usually noticeable after the weak tubes have been replaced.

(c) PRECAUTIONS FOR SATISFACTORY TUBE LIFE.

(1) Before any tube is removed from the equipment, make certain the primary power is disconnected from the equipment.

(2) Operate all tubes within ±5% of rated filament voltage.

(3) Do not exceed the rated plate current of any tube during normal operation of the equipment.

(d) TUBE REPLACEMENT PRECAUTIONS.

(1) All tubes are removed by pulling them straight away from the chassis.

(2) Remove plate cap connectors, from tubes so equipped, with great care to prevent breaking the seal around the plate cap.

(3) Before a tube is inserted, make certain that the type of tube is correct for the socket into which it is being placed.

NOTE

Changing master oscillator tubes (V001) may cause a slight change in master oscillator calibration.

(e) TUBE TABLE.

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V001	6SJ7	Master oscillator	6.3
V101	6AK6	Buffer amplifier	6.3
V102	6AG7	Frequency multiplier	6.3
V103	7C5	Frequency multiplier	6.3

TUBE TABLE

SYMBOL	TYPE	FUNCTION	RATED FIL. VOLTAGE
V104	705	Frequency multiplier	6.3
V105	4D32	Power Amplifier	6.3
V201	6SL7	Audio Amplifier	6.3
V202	6SN7	Audio driver	6.3
V203	807	Modulator	6.3
V204	807	Modulator	6.3
V205	6SL7GT	Sidetone Oscillator	6.3
V301	5Z4	LV Rectifier	5.0
V302	5R4GY	HV Rectifier	5.0
V303	5R4GY	HV Rectifier	5.0
V304	VR75	Bias Regulator	---
V305	OA2	Screen Voltage Limiter	---
V306	OA2	Screen Voltage Limiter	---

(f) RELAYS. - All relays should be inspected at regular intervals. Check the contacts for proper alignment, pitting and corrosion. Use a burnishing tool to clean contacts - never use sandpaper or emery cloth.

5.2. TROUBLE SHOOTING.

5.2.1. GENERAL. - The most general cause of improper operation of radio equipment is tube failure. Refer to paragraph 5.1.2., (b) in this section for comments concerning vacuum tube replacement. Defective tubes causing an overload in power circuits may usually be located by inspection. High voltage arcs may be caused by bent condenser plates, corrosion or dust. Corrosion resulting from operating the equipment in a salt laden atmosphere may cause failure of the equipment for no apparent reason.

In general, trouble encountered in radio apparatus may be isolated by means of various tests and measurements, and the section of the transmitter determined in which the trouble is located. If this is done, the components in the associated circuit may be checked and the trouble located. Refer to the tables of meter readings and resistance measurements.

No one but an authorized and competent service man equipped with proper test facilities should be permitted to service this equipment.

5.2.2. FUSES.

(a) GENERAL. - This equipment is supplied with fuses of the correct rating in each position. Fuse failures should be replaced with spares only after the circuit in question has been carefully examined to make certain that no permanent fault exists. Always replace a fuse with the rating specified in the following table:

FUSE TABLE

SYMBOL	LOCATION	TYPE	RATING
F301	LV Power supply primary	Cartridge (3AG)	3 amp.
F302	HV Power supply primary	Cartridge (3AG)	5 amp.

5.3. ALIGNMENT.

5.3.1. GENERAL. - Should, for any reason, the exciter stages get out of alignment, it is recommended that the unit be realigned at once. Improper operation might result in damage to valuable equipment.

5.3.2. HIGH FREQUENCY OSCILLATOR. - Should trouble develop in the high frequency master oscillator, the unit should be returned to the factory for servicing. However, the unit can be serviced and realigned by persons understanding such techniques providing accurate test equipment is at hand. A crystal controlled frequency standard with outputs at 1700 and 2000 kc with an accuracy of better than .015 percent, must be used for setting the band edges.

(a) PROCEDURE.

(1) Apply power to the transmitter and let the MO warm up for about 30 min. then check the oscillator frequency on a receiver. Operate the transmitter with the emission control in the CAL position and the key closed.

(2) Couple a receiver to the output of the oscillator.

(3) Set the vernier index to exact center of the dial window.

(4) Tune receiver to output of 1700 kc freq. standard.

(5) Rotate MO to vicinity of 3400 kc on the exciter dial and zero beat with the signal from the standard. Write dial reading down for use as a reference.

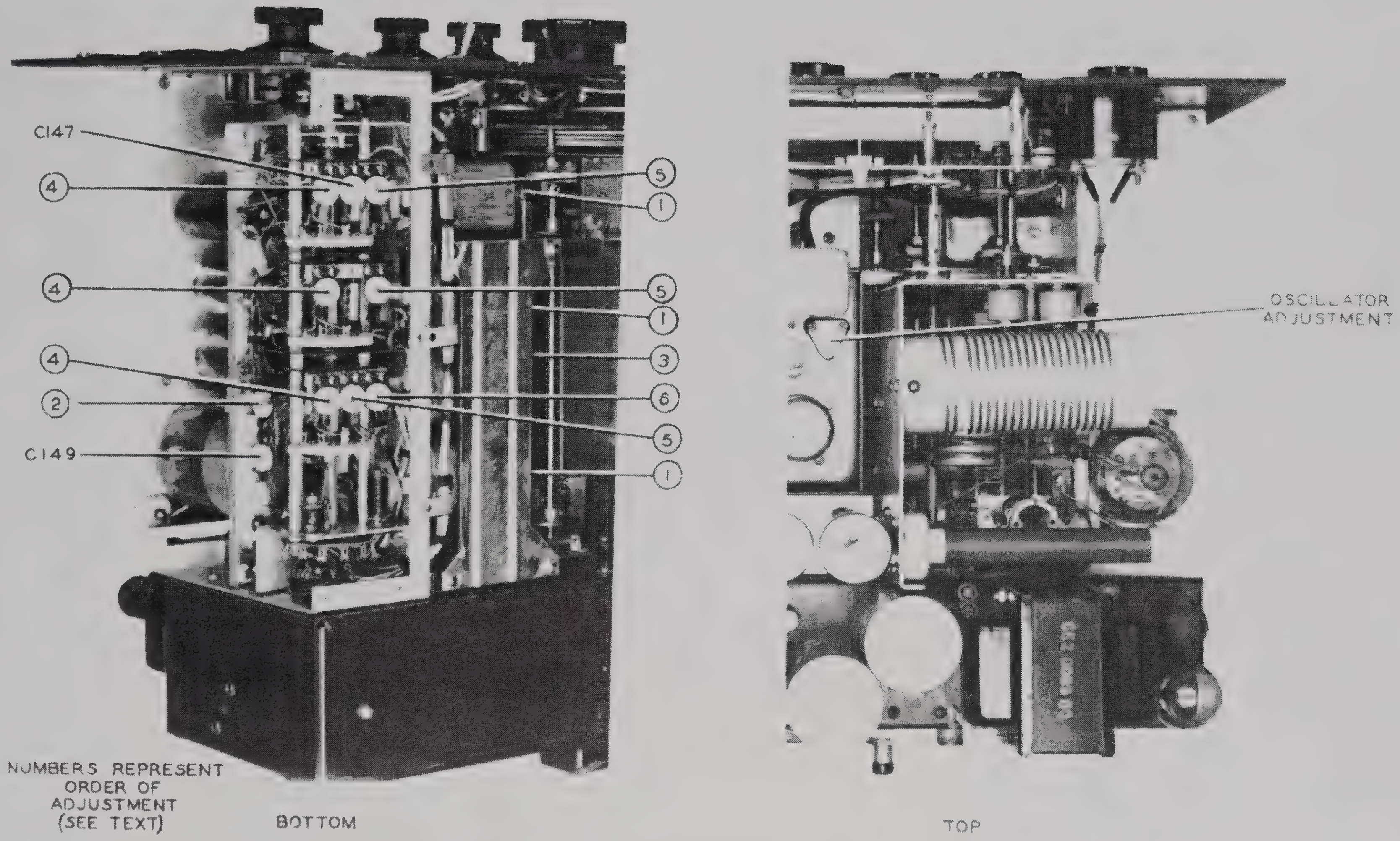
(6) Rotate the MO dial toward 4 mc exactly 12 turns.

(7) Tune the receiver to the 2000 kc output of the standard.

(8) The MO should zero beat with the 2000 kc output of the standard at exactly 12 turns of the MO dial.

(9) If such is the case but the dial reading is incorrect, loosen the set screws in the oscillator coupler and turn the dial to the correct reading (4000 kc) after which tighten the set screws again. If the MO does not zero beat with the standard at 4 mc, proceed as follows:

(10) Read the kc difference (the difference of where the signal appeared from where it should have appeared after 12 turns) and multiply it by 5. Add this figure to the actual beat note dial setting if the beat note was less than 12 turns or subtract it if the beat note occurred at more than 12 turns. Now set the dial to this new frequency, remove the trimmer plug from the top of the oscillator, and turn the adjustment until zero beat is again reached. It will be found that the high and low ends are very nearly 12 turns apart. Repeat the above procedure until such is the case; remember that a new reference point will occur at the low end of the dial each time.



NUMBERS REPRESENT ORDER OF ADJUSTMENT (SEE TEXT)

BOTTOM

TOP

FIGURE 5-1 ALIGNMENT ADJUSTMENTS

Examples of above operations:

#1

Beat note at low end of dial = 3402 kc
Reading at which beat note should appear after 12 turns of dial = 4002 kc
Actual dial reading = 4003 kc
Difference frequency (4003 - 4002) = 1 kc
Multiplied by 5 = 5 kc
Subtracted from 4003 (since beat note occurred at more than 12 turns) = 3998 kc

After setting dial to 3998 kc and zero beating the MO to the standard with the trimmer adjustment, the low end beat note should appear at 3398 kc.

#2

Beat note on low end of dial = 3498 kc
Reading at which dial should appear after 12 turns = 3998 kc
Actual dial reading = 3996 kc
Difference frequency (3998 - 3996) = 2 kc
Multiplied by 5 = 10 kc
Added to 3996 (since beat note occurred at less than 12 turns of the dial) = 4006 kc

After setting the dial at 4006 and zero beating the MO to the standard with the trimmer adjustment, the low end beat note should appear at 3406 kc.

(11) After the oscillator has been adjusted to cover the range 3400 to 4000 kc in exactly 12 turns, the coupler set screws can be loosened and the dial set on frequency.

NOTE

The above method of adjustment is that which is used at the factory. This is a short cut method and proves very reliable. Actually, the object is to get the 1700 kc and the 2000 kc outputs of the oscillator exactly 12 turns apart and it can be attained by using the slower method of moving the trimmer capacitor in one direction or the other and checking the results until the desired answer is obtained. Be sure to replace the trimmer cover plug after alignment.

NOTE

Somewhat greater accuracy can be obtained if the oscillator end points are set using harmonic operation i.e. listen in the 14 or 28 mc region for the harmonics of the 1700 and 2000 kc signals and set the corresponding harmonic of the MO to zero beat with these. Do this only after obtaining a very close adjustment as outlined above.

5.3.3. MULTIPLIER STAGES. - Should the grid drive to the final fall below 5 ma on the meter due to change of tubes or aging of components, the transmitter r-f circuits should be realigned. Proceed as outlined below only after the master oscillator has been checked and recalibrated as outlined in paragraph 5.3.2.

A small fiber screwdriver and a 1/4" open end wrench are required for these adjustments.

(a) PROCEDURE.

(1) Remove the transmitter from the cabinet and tip it up on end. (RF section up).

(2) Remove the fuse from the HV primary. (This allows the low voltage supply to be turned on while the HV supply remains turned off.)

(3) Turn the LV and HV power switches ON.

(4) Place the CW-CAL-PH switch in the PH position.

(5) Place the METER selector switch in the GRID position.

(6) Adjust for maximum grid current using the adjustments and conditions listed below in order from top to bottom of the list. (Refer to figure 5-1 for adjustment identification.)

ORDER OF ADJUSTMENT	BAND SW SET AT	TUNING SET AT	ADJUSTMENT
1	10M	28,800	3 Slugs marked "28.8"
2	40M	7,300	C150
3	40M	7,200	1 Slug marked "7.2"
4	15M	21,600	3 Trimmers marked "21.6"
5	20M	14,250	3 Trimmers marked "14.4"
6	80M	3,750 kc	1 Trimmer marked "3.6"

NOTE

In item 4 under ADJUSTMENT, the mistracking of the third multiplier plate circuit will result in low grid current when the main tuning dial is set much outside the limits of the amateur 20 meter band (14 to 14.4 mc). Proper grid current can be obtained at any frequency on the range 12.8 - 16 mc by adjustment of trimmer C137 (marked 14.4) on the third multiplier.

NOTE

If extensive multiplier alignment has been necessary, it is likely that the two spurious signal traps will need tuning. Do not touch the spurious signal tuning condensers unless this is so, since these adjustments are very critical. The spurious signal trap tuning condenser for the 80 meter band, C149 is located on the side of the multiplier unit next to C150, see figure 5-4. These traps are tuned as follows: With the transmitter aligned as indicated in the above paragraphs, tune the transmitter for 3.5 mc output and listen with a receiver to the 1.75 mc output. Watching the receiver "S" meter, tune C147 for minimum signal. Then tune the transmitter up on 7.15 mc and listen on 3.575 mc with the receiver. Adjust C149 for minimum signal. Both of these adjustments will be very sharp and care should be taken that they are not disturbed in the least after the adjustments have been made. Replace the multiplier bottom cover.

5.3.4. MODULATOR BIAS ADJUSTMENT. - The modulator bias can be adjusted by turning the screwdriver slot equipped potentiometer R305. For best distortion characteristics, the static, or resting, modulator plate current should be 55 ma with the 600 - 700 v switch in the 700 v position. Potentiometer R305 is located within the top of the cabinet near the filter capacitors, therefore, the interlock switch will have to be held closed while making this adjustment. Take great care to avoid touching any components carrying high voltage!

The proper bias for the modulator grids is approximately minus 25 volts.

5.4. LUBRICATION. - The following parts should be lubricated annually or whenever the need arises by brushing a thin film of the indicated lubrecant on the points of mechanical contact. Don't over-lubricate.

(a) PA Bandswitch Contacts: MOBILE PD535A (Socony Vacuum Oil Co.)

(b) Panel Bushings: MOBILE PD535A (Socony Vacuum Oil Co.)

5.5. OSCILLATOR TUBE REMOVAL. - Replacing an oscillator tube requires the breaking of the seal around the shield and it will then become necessary to reseal the shield. If it becomes necessary to replace an oscillator tube, use a glyptal cement or a generous application of Duco cement to reseal the shield.

5.6. DESICCANT CAPSULE. - A silica-gel tube is mounted on the top of the oscillator shield. The silica-gel absorbs moisture from within the oscillator and aids in retaining the oscillator calibration. Moisture causes the color of the silica-gel to change from blue to pink. The silica-gel tube is screwed into a hole in the shield. The plastic tube should be replaced by a new tube of silica-gel when all of the material within the tube has changed from blue to pink. New tubes of silica-gel may be ordered from the Collins Radio Company.

NOTE

The seal around the oscillator tube shield and the silica-gel tube is more easily broken if the parts are warm. This can be done safely with a light bulb or infra-red lamp placed close to the oscillator.

TYPICAL TEST VOLTAGES

DC Voltages to Ground measured with Volt-ohmyst. Conditions: Phone - No Mod. Readings taken at LF end of each band.

Tube	Pin	R.F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V101	6AK6						
G1	1	-17.0	-16.5	-1.0	-0.9	-1.0	-0.9
K	2, 7	1.0	1.0	2.9	2.85	2.85	2.9
P	5	235	230	230	225	225	225
G2	6	155	150	65	65	65	65
V102	6AG7						
K	1,3,5	2.6	2.6	3.9	3.2	3.4	3.2
G1	4	-18.	-18.	-36	-36	-38	-36
G2	6	220	215	205	205	205	210
P	8	230	230	220	220	225	225

Tube	Pin	R.F.					
		3.5	7.0	14.0	21.0	27.2	28.0
V103	7C5						
P	2	235	235	215	210	215	215
G2	3						
G1	6	-24.	-23.	-56.	-21.	-69.	-51.
K	7	25.	25.	27.	27.	26.	26.
V104	7C5						
P	2	225	220	215	215	215	215
G2	3						
G1	6	-115	-110	-170	-175	-150	-150
K	7	-59	-56	-52	-52	-51	-50
V105	RK-4D32						
G2	2	285	300	300	300	295	295
K	4, 5	0	0	0	0	0	0
G1	6	-120	-100	-93	-105	-105	-102
P	Cap	690	680	690	690	690	690

DC Voltages to Ground in Audio System (Volt-ohmyst)

4D32 Plate Current = 220 MA E_p = 700 V Key Down

	Audio Amplifier V201, 6SL7GT			Driver V202, 6SN7GT			Modulator V203, & 4, 807			Sidetone Osc. V205, 6SL7GT		
		PH	CW		PH	CW		PH	CW		PH	CW
Pin 1	G	-0.6	-0.8	G	0	0				G	-.5	-3.0
2	P	88.	-0.9	P	235	235	G2	235	0	P	-.8	25
3	K	0	0	K	7.4	7.4	G1	-25	-25	K	0	0
4	G	0	0	G	0	0	K	0	0	G	-.3	-0.5
5	P	100	100	P	235	235	---	---	---	P	-.8	24
6	K	0.8	0.8	K	7.4	7.4	P	720	740	K	0	---
7												
8												

Key up - key down conditions of V105 (4D32)
CW operation
f = 7 mc

	Key up	Key down
Plate E	820	740
Plate I	0	220
Screen E	300	300

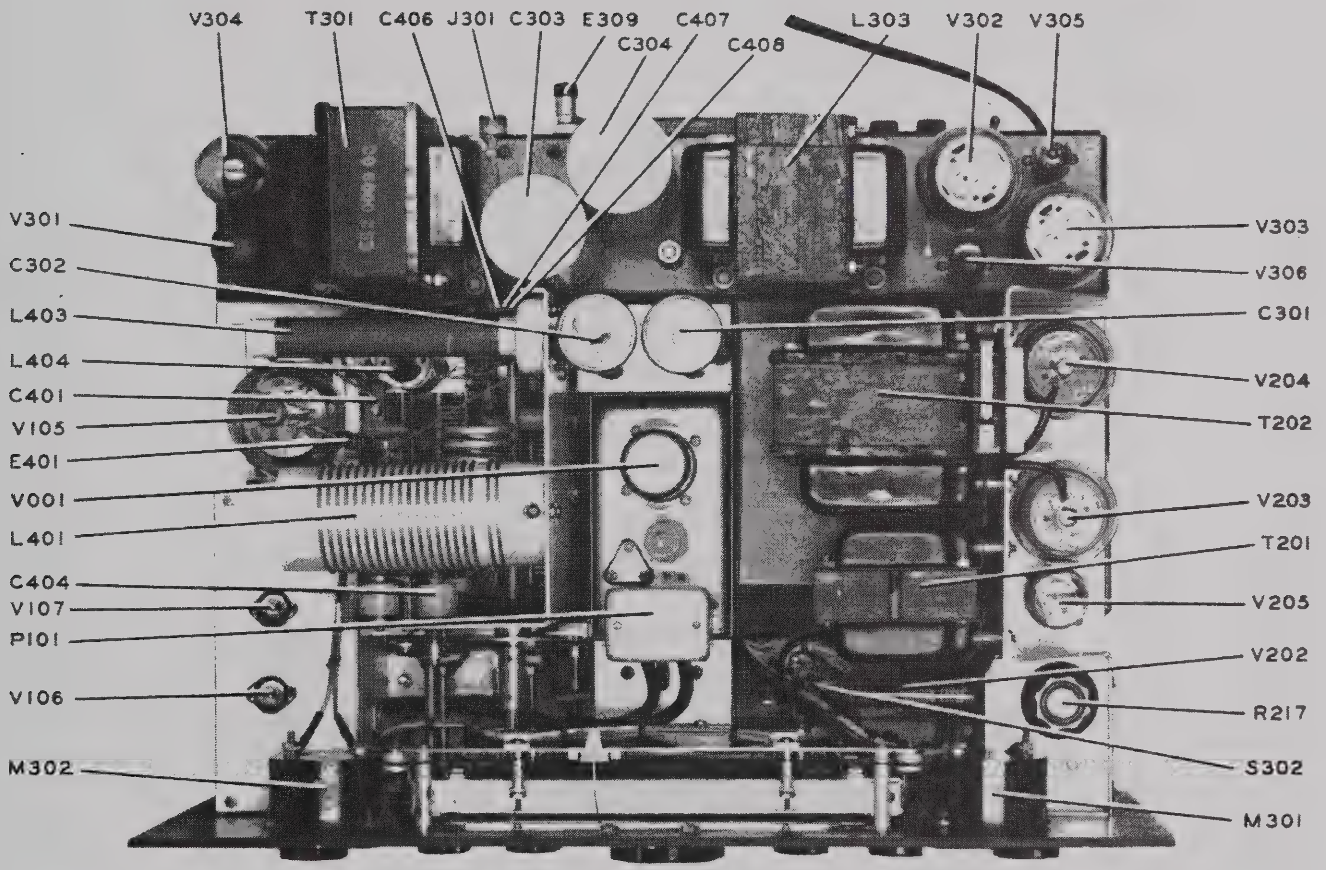


FIGURE 5-2 32V-2 PARTS ARRANGEMENT - TOP VIEW

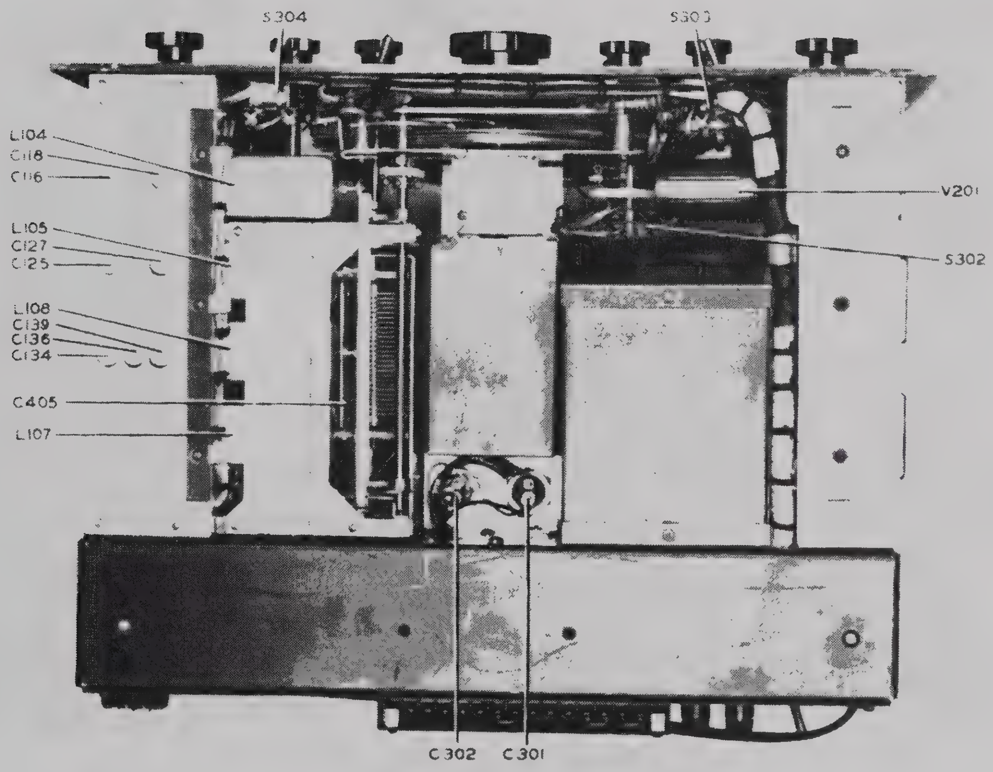


FIGURE 5-3 32V-2 PARTS ARRANGEMENT-BOTTOM VIEW

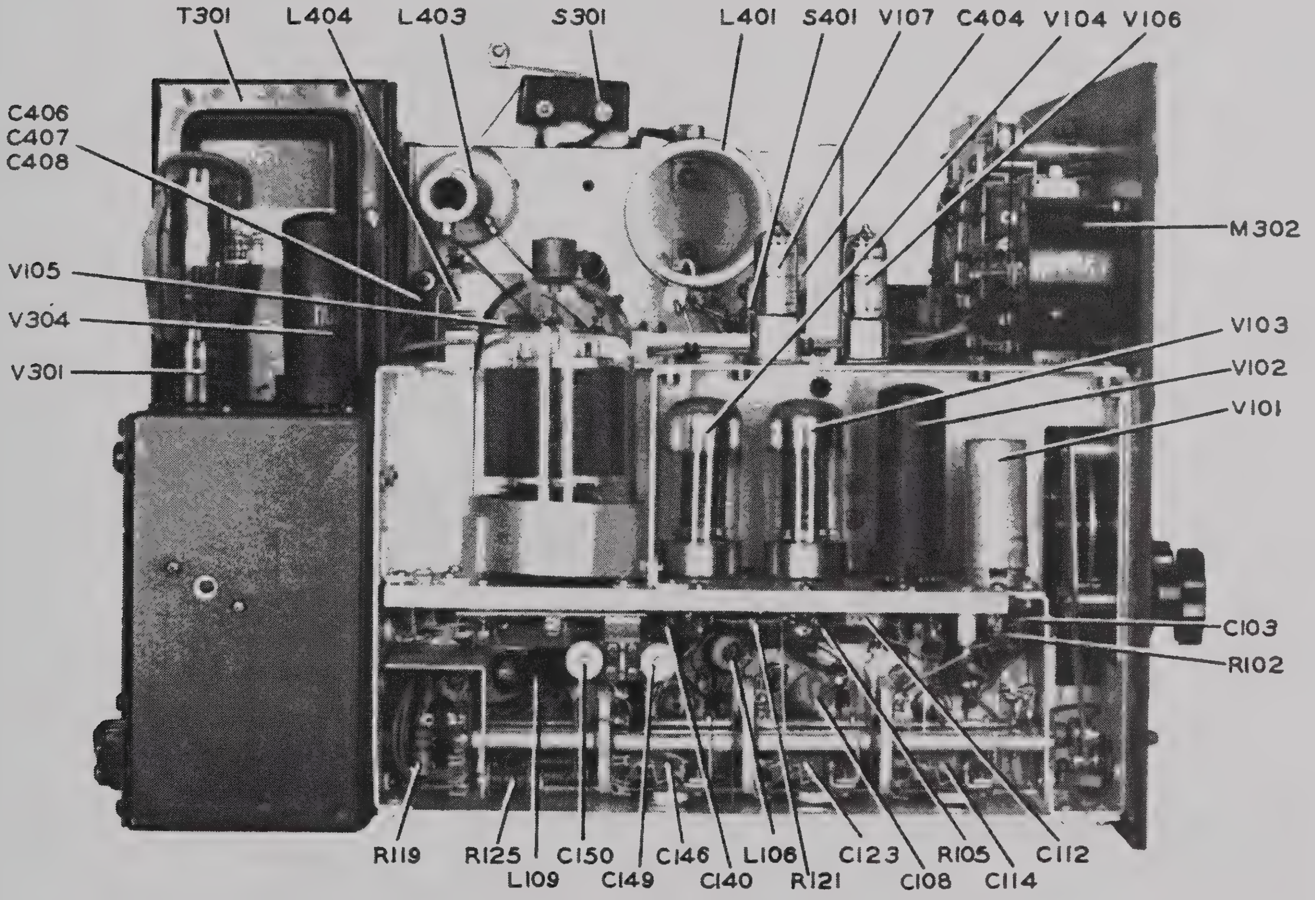


FIGURE 5-4 32V-2 PARTS ARRANGEMENT-LEFT SIDE OPEN

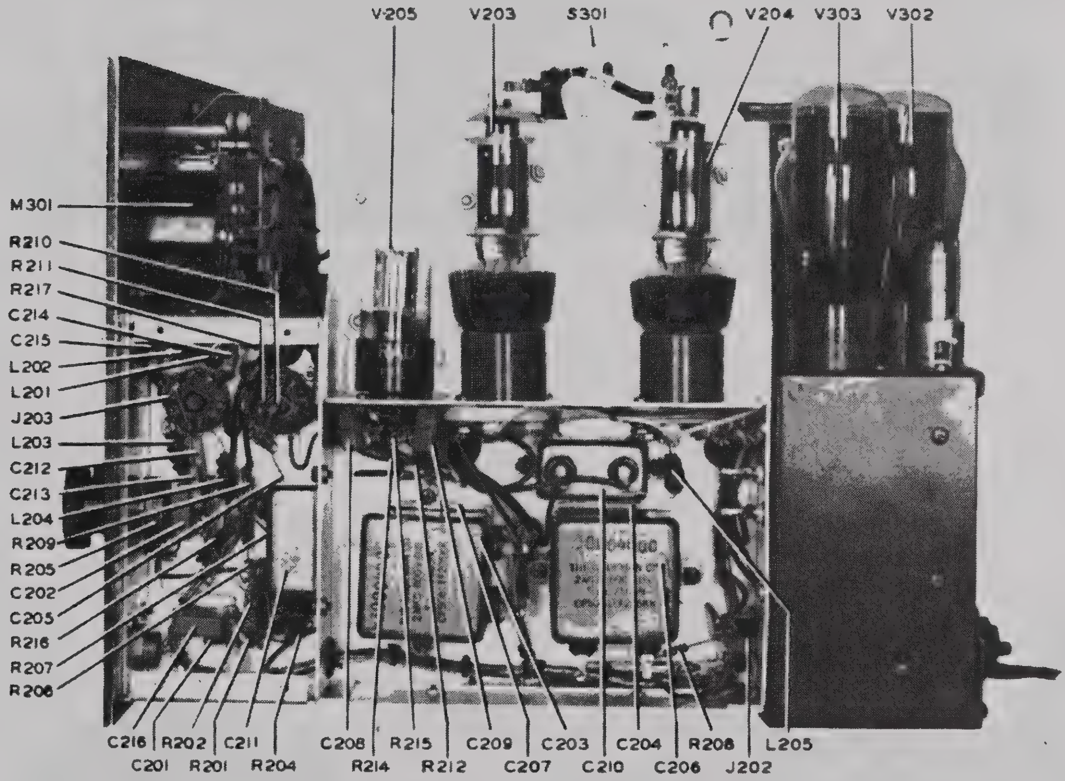


FIGURE 5-5 32V-2 PARTS ARRANGEMENT - RIGHT SIDE OPEN

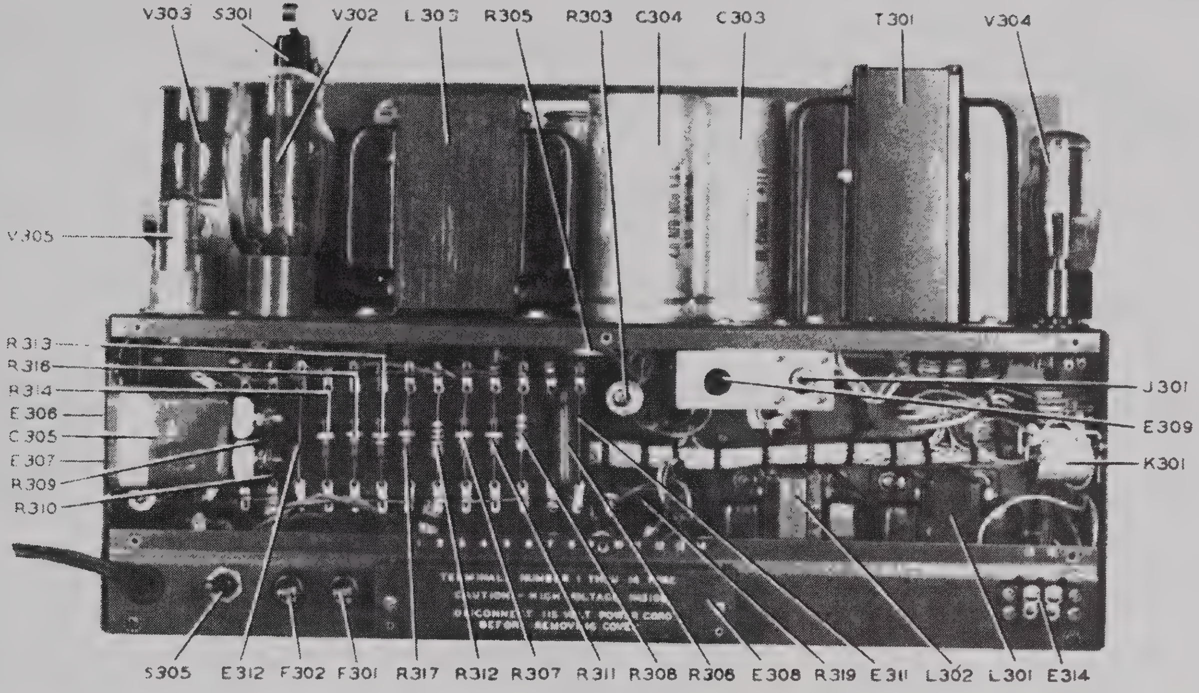


FIGURE 5-6 32V-2 PARTS ARRANGEMENT-REAR OPEN

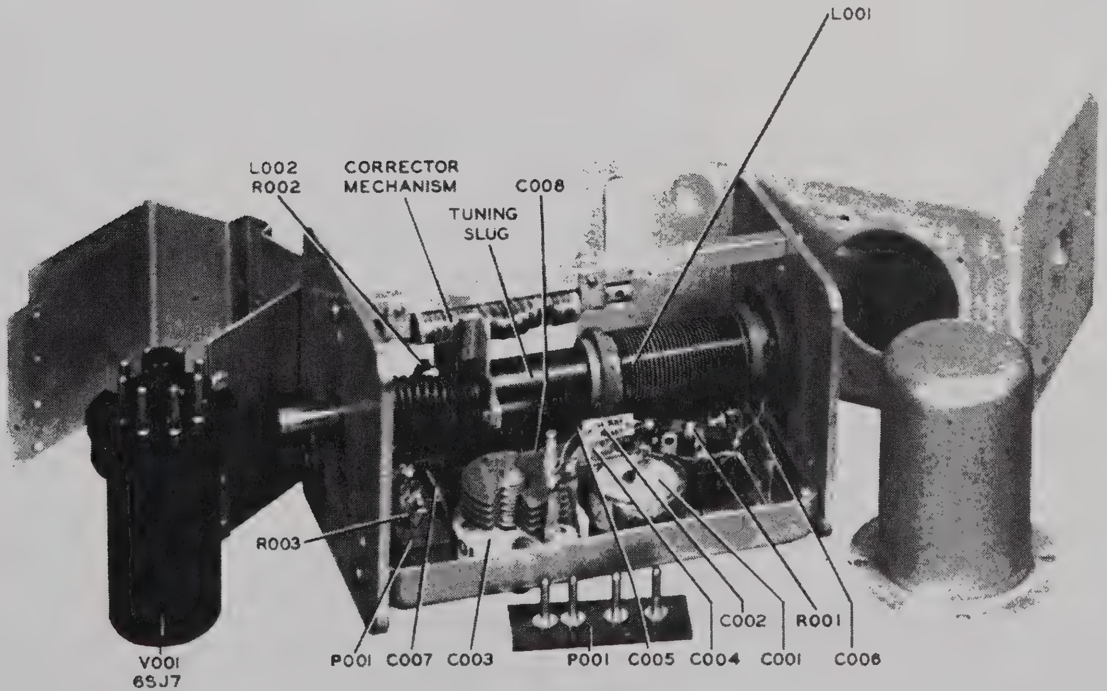


FIGURE 5-7 PARTS ARRANGEMENT 70E-8-OPEN

SECTION 6
PARTS LIST

32V-2 TRANSMITTER

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C101	Buffer Amp. Coupling	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C102	Osc. Plate Filter	CAPACITOR: Ceramic; 10,000 mmf p/m 20% 350 WV	913 0106 00
C103	Buffer Grid Voltage Divider	CAPACITOR: Ceramic; 30 mmf p/m 2%; 500 WV	913 0118 00
C104	Buffer Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C105	Buffer Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C106	Buffer Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C107	1st Mult. Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C108	1st Mult. Grid By-pass	CAPACITOR: Paper; 100,000 mmf p/m 10%; 400 WV	931 3020 00
C109	1st Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C110	1st Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C111	Key Click Filter	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C112	2nd Mult. Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C113	1st Mult. Plate By-pass	CAPACITOR: Mica; 650 mmf p/m 2%; 500 WV	935 5061 00
C114	1st Mult. Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 5%; 500 WV	935 0077 00
C115	1st Mult Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 10%; 500 WV	935 0078 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C116	1st Mult. Plate Tuning	CAPACITOR: Ceramic 8-50 mmf; 350 WV	917 1038 00
C117	1st Mult. Plate Tuning	CAPACITOR: Mica; 180 mmf p/m 5%; 500 WV	935 0116 00
C118	1st Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C119	2nd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C120	2nd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C121	2nd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C122	3rd Mult. Coupling	CAPACITOR: Ceramic; 100 mf p/m 10%; 500 WV	916 4003 00
C123	2nd Mult. Plate Tuning	CAPACITOR: Mica; 20 mmf p/m 5%; 500 WV	935 0076 00
C124	2nd Mult. Plate Tuning	CAPACITOR: Mica; 22 mmf p/m 10%; 500 WV	935 0078 00
C125	2nd Mult Plate Tuning	CAPACITOR: Ceramic; 8-50mmf; 350 WV	917 1038 00
C126	2nd Mult. Plate Tuning	CAPACITOR: Mica; 150 mmf p/m 2%; 500 WV	935 0184 00
C127	2nd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C128	3rd Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C129	3rd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C130	3rd Mult. Screen By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C131	3rd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C132	3rd Mult. Plate By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C133	2nd Mult. Cathode By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C134	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C135		CAPACITOR: Not Used	
C136	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C137	3rd Mult. Plate Tuning	CAPACITOR: Mica; 120 mmf p/m 5%; 500 WV	935 0109 00
C138		CAPACITOR: Not Used	
C139	3rd Mult. Plate Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C140	PA Coupling	CAPACITOR: Ceramic; 100 mmf p/m 10%; 500 WV	916 4003 00
C141	PA Grid By-pass	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C142	PA Screen By-pass	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C143		CAPACITOR: Not Used	
C144	PA Filament By-pass	CAPACITOR: Mica; 500 mmf p/m 20%; 500 WV	912 0302 00
C145	3rd Mult. Plate Blocking	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C146	3rd Mult. Plate Tuning	CAPACITOR: Mica; 20 mmf p/m 5%; 500 WV	935 0076 00
C147	160 Meter Tap Tuning	CAPACITOR: Ceramic 8-50 mmf; 350 WV	917 1038 00
C148	80 Meter Tap Fixed Tuning	CAPACITOR: Mica, 120 mmf p/m 5%; 500 WV	935 0109 00
C149	80 Meter Tap Var. Tuning	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C150	L108 Trimmer	CAPACITOR: Ceramic; 8-50 mmf; 350 WV	917 1038 00
C201	Audio Input r-f filter	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C202	Audio coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C203	V201 Plate by-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C204	V201 Plate by-pass	CAPACITOR: Paper; 2 mf p/m 10%; 600 WV	930 0046 00
C205	Driver grid coupling	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C206	Driver cathode by-pass	CAPACITOR: Paper 2 mf p/m 10%; 600 WV	930 0046 00
C207	Mod. cathode by-pass	CAPACITOR: Paper, 2 mf p/m 10%; 600 WV	930 0046 00
C208	Sidetone feedback	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C209	Sidetone feedback	CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C210	Sidetone coupling	CAPACITOR: Paper; .5 mf p/m 20%; 600 WV	956 2086 40
C211	Audio plate decoupling	CAPACITOR: Paper; .5 mf p/m 20%; 600 WV	956 2086 40
C212	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C213	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C214	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C215	R-F by-pass	CAPACITOR: Mica; 47 mmf p/m 20%; 500 WV	935 0093 00
C216		CAPACITOR: Mica; 10,000 mmf p/m 10%; 300 WV	935 2117 00
C301	LV rect. filter	CAPACITOR: Paper; 4 mf plus 40 -15%; 600 WV	961 3005 00
C302	LV rect. filter	CAPACITOR: Paper; 4 mf plus 40 -15%; 600 WV	961 3005 00
C303	HV rect. filter	CAPACITOR: Paper; 8 mf p/m 20%; 1000 WV	930 0150 00
C304		CAPACITOR: Not Used	
C305		CAPACITOR: Paper; .25 mf p/m 10%; 2000 WV	930 7220 00
C401	PA Plate blocking	CAPACITOR: Mica; 1000 mmf p/m 20%; 2500 WV	936 0250 00
C402	PA Plate by-pass	CAPACITOR: Mica; 2200 mmf p/m 20%; 2500 WV	936 1083 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C403	Final tuning	CAPACITOR: Variable air dielectric; dual sect; 10-150 mmf per sect	920 0011 00
C403A	Part of C403	CAPACITOR: Section of C403	
C403B	Part of C403	CAPACITOR: Section of C403	
C404	Antenna network	CAPACITOR: Ceramic; 50 mmf p/m 10%; WV; 2500 Vrms at 2 mc. 1000 v rms at 16 mc	913 4503 20
C405	Antenna loading	CAPACITOR: Variable air-dielectric; single sect; 15-300 mmf	920 0014 00
C406	Antenna loading	CAPACITOR: Mica; 220 mmf p/m 10%; 2500 WV	936 0205 00
C407	Antenna loading	CAPACITOR: Mica; 470 mmf p/m 5%; 2500 WV	936 0226 00
C408	Antenna loading	CAPACITOR: Mica; 220 mmf p/m 10%; 2500 WV	936 0205 00
E304	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E305	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E306	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E307	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00
E308	Rear terminal strip	CONNECTOR: 14 term, barrier type strip w/lugs on back	367 0022 00
E309	Ground connector	POST, BINDING: Push type; 1/8" wire hole	372 1400 00
E313	Wire tie point	TERMINAL: Ceramic bushing 13/32" diam x 5/16" thk w/solder lug 17/32" lg	190 1103 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
E314	Sidetone and muting	TERMINAL STRIP: Bakelite; 2 terminals	367 0010 00
E401	Parasitic suppressor	CHOKE: 3T #20 wire; wound on 100 ohm 2 watt resistor	503 3452 002
F301	LV and filament	FUSE: 3 amp; 250 v	264 4080 00
F302	High voltage	FUSE: 5 amp; 250 v	264 4090 00
I301	Pilot lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
I302	Pilot lamp	BULB: Pilot light; 110 v, 55 ma; 6 w; candelabra base; T4-1/2 bulb	262 3330 00
I303	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I304	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I305	Dial lamp	BULB: Pilot light; 6 v, .2 amp midget flange base; T1-3/4 bulb	262 0023 00
I306	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I307	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flang base; T1-3/4 bulb	262 0023 00
I308	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I309	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I310	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I311	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
I312	Dial lamp	BULB: Pilot light; 6 v, .2 amp; midget flange base; T1-3/4 bulb	262 0023 00
J101	Key	JACK: Phone single circuit, midget	360 0008 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
J102	Cable	CONNECTOR: Std octal socket	220 1850 00
J201	Microphone	CONNECTOR: 2 female contacts; wall mtg	369 1004 00
J202	Modulator	CONNECTOR: Std octal socket	220 1850 00
J203	Sidetone power	CONNECTOR: Std octal socket	220 1850 00
J301	Antenna Connector	CONNECTOR: Single round female contact	357 9005 00
K301	Carrier control	RELAY: Circuit control; contacts 1A1B1A and 2A; 48 v coil	970 1014 00
L101	Osc. plate choke	COIL: RF choke; 4 pi; duo-lat wound; 2.5 mh p/m 20%; .125 amp	240 2100 00
L103	Buffer plate choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L104	1st Mult. Tuning	COIL: LF; 38T #28 wire	503 2896 002
L105	2nd Mult. Tuning	COIL: MF; 17.3T #28 wire	503 2895 002
L106	2nd Mult. Plate Choke	COIL: RF choke; 2 pi; duo-lat wound; 208 uh	240 6000 00
L107	3rd Mult. tuning	COIL: HF 7.6T #28 wire	503 2835 001
L108	3rd Mult. tuning	COIL: LF; 38T #28 wire	503 2896 002
L109	PA grid choke	COIL: RF choke; 4 pi; duo-lat wound; 2.5 mh p/m 20%; .125 amp	240 2100 00
L110	3rd Mult. tuning	COIL: 23T #26 wire	503 4512 001
L111	1st Mult. Plate Choke	COIL: RF choke; 3 pi; universal wound; 1 mh plus 20 minus 10%	240 0047 00
L112	3rd Mult. Plate Choke	COIL: RF choke; 3 pi; universal wound; 1 mh plus 20 minus 10%	240 0047 00
L201	Sidetone input filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L202	Sidetone output filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L203	Sidetone audio input r-f choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L204	Audio r-f filter choke	COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L205		COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L206		COIL: RF choke; 500 uh p/m 10%; 4 pi; universal wound	240 0042 00
L301	LV filter	REACTOR,FILTER: 11 hy p/m 15%	668 0012 00
L302	LV filter	REACTOR,FILTER: 11 hy p/m 15%	668 0012 00
L303	HV filter	REACTOR,FILTER: 5 hy p/m 15%	668 0055 00
L401	PA plate tuning	COIL: LF tank; 20T #14 wire	503 2892 002
L402	PA plate tuning (28 mc)	COIL: HF tank; 5T silver pl copper tubing	503 2831 001
L403	PA plate choke	COIL: RF choke; 5 pi; duo-lat wound; 3.5 mh p/m 10%	504 3667 003
L404	Network coil	COIL: Output; 32 turns; #18 wire	503 6486 001
M301	Mult. purpose	METER: 0-5 ma DC; 50 scale div; marked 0-250, 0-500, 0-1000	458 0110 00
M302	PA plate	METER: 0-500 mc DC; 50 scale div.	450 1500 00
P101	Osc. power	CONNECTOR: 4 prong plug; part of oscillator filter assem.	503 2868 002
P201	Microphone	CONNECTOR: 2 prong plug	369 1005 00
P301	Modulator power	CONNECTOR: Std 8 term octal plug	369 1009 00
P302	RF circuits power	CONNECTOR: Std 8 term octal plug	369 1009 00
P303	Sidetone power	CONNECTOR: Std 8 term octal plug	369 1009 00
P304		CONNECTOR: Single round male contact	357 9006 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R101		RESISTOR: Not used	
R102	Buffer grid	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R103	Buffer cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R104	Buffer screen	RESISTOR: .33 megohm p/m 10%; 1/2 w	745 1191 00
R105	V101, V102, V103 grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R106	1st Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R107	1st Mult. cathode	RESISTOR: 820 ohm p/m 10%; 1/2 w	745 1083 00
R108	1st Mult. screen	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R109	1st Mult. plate decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R110	2nd Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R111	2nd Mult. screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R112	2nd Mult. plate decoupling	RESISTOR: 1000 ohm p/m 10%; 1 w	745 3086 00
R113	3rd Mult. grid	RESISTOR: .10 megohm p/m 10%; 1/2 w	745 1170 00
R114	3rd Mult. screen	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R115	3rd Mult. plate decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R116	3rd Mult. plage decoupling	RESISTOR: 470 ohm p/m 10%; 1 w	745 3072 00
R117	3rd Mult. grid stabilizer	RESISTOR: 10 ohm p/m 10%; 1/2 w	745 1002 00
R118	2nd Mult. cathode	RESISTOR: 1500 ohm p/m 10%; 1/2 w	745 1093 00
R119	PA grid meter shunt	RESISTOR: 6.2 ohm p/m 5%; 1/2 w	707 0104 00
R120	PA grid	RESISTOR: 3300 ohm p/m 10%; 1 w	745 3107 00
R121	3rd Mult. grid voltage divider	RESISTOR: .22 megohm p/m 10%; 1/2 w	745 1184 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R122	3rd Mult. grid return	RESISTOR: 680 ohm p/m 10%; 2 w	745 5079 00
R123	PA screen stabilizer	RESISTOR: 47 ohm p/m 10%; 1 w	745 3030 00
R124		RESISTOR: Not used	
R125	Dial light dropping	RESISTOR: 2 ohm p/m 10%; 2 w	710 1070 00
R126		RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R127		RESISTOR: 5600 ohm p/m 10%; 2 w	745 5118 00
R201	Audio input r-f filter	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R202	V201 grid	RESISTOR: 1.0 megohm p/m 10%; 1/2 w	745 1212 00
R203		RESISTOR: Not used	
R204	V201 cathode	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R205	Audio gain control	RESISTOR: .5 megohm p/m 20%; 1/2 w	376 3027 00
R206	V201 plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R207	V201 plate	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R208	V201 plate decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R209	V201 plate decoupling	RESISTOR: 47,000 ohm p/m 10%; 1/2 w	745 1156 00
R210	V202 grid	RESISTOR: .47 megohm p/m 10%; 1/2 w	745 1198 00
R211	V202 cathode	RESISTOR: 560 ohm p/m 10%; 1/2 w	745 1076 00
R212	Sidetone plate	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R213	Sidetone plate	RESISTOR: 22,000 ohm p/m 10%; 1/2 w	745 1142 00
R214	Sidetone grid	RESISTOR: 4700 ohm p/m 10%; 1/2 w	745 1114 00
R215	Sidetone grid	RESISTOR: 10,000 ohm p/m 10%; 1/2 w	745 1128 00
R216	Audio decoupling	RESISTOR: 2200 ohm p/m 10%; 1 w	745 3100 00
R217	Sidetone pitch control	RESISTOR: .5 megohm p/m 20%; 1/2 w	376 3027 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R301	V105 screen dropping	RESISTOR: 12,000 ohm p/m 5%; 25 w	710 0366 00
R302		RESISTOR: Not used	
R303	Load stabilizing	RESISTOR: 7500 ohm p/m 10%; 25 w size	710 0069 00
R304	V105 screen bleeder	RESISTOR: 25,000 ohm p/m 10%; 25 w size	710 3254 20
R305	Mod. bias control	RESISTOR: Variable; ww; 1000 ohm ± 10%; 4 w	377 0007 00
R306	Bias bleeder	RESISTOR: 750 ohm p/m 5%; 10 w	710 1750 10
R307	LV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R308	LV meter shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R309	Relay voltage divider	RESISTOR: 5000 ohm p/m 10%; 10 w	710 1542 00
R310	Relay voltage divider	RESISTOR: 7500 ohm p/m 10%; 10 w	710 0033 00
R311	LV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R312	HV meter shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R313	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R314	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R315	Mod. shunt meter	RESISTOR: Wire wound; .51 ohm p/m 5%; 1/2 w	707 0026 00
R316	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R317	HV bleeder	RESISTOR: 0.10 megohm p/m 5%; 2 w	745 5169 00
R318	Mod ind. shunt	RESISTOR: 25 ohm p/m 5%; 1/2 w	701 0001 00
R319		RESISTOR: 2000 ohm p/m 10%; 10 w	710 1242 00
R320	Series Tuning	RESISTOR: Wire wound; 15 ohm p/m 10%; .25 w	710 3152 00
R321	Series Tuning	RESISTOR: Wire wound; 15 ohm p/m 10%; .25 w	710 3152 00
S101	Band change switch	SWITCH: 8 pole, 5 pos, 4 sect; non-shorting	503 2923 004

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S101A		SWITCH: Part of S101	
S101B		SWITCH: Part of S101	
S101C		SWITCH: Part of S101	
S101D		SWITCH: Part of S101	
S101E		SWITCH: Part of S101	
S101F		SWITCH: Part of S101	
S101G		SWITCH: Part of S101	
S101H		SWITCH: Part of S101	
S301	Cabinet lid interlock	SWITCH: SP normally open snap switch	260 0708 00
S302	Emission selector	SWITCH: Band change; 8 pole; 3 pos, 3 sect; non-shorting	259 0264 00
S302A		SWITCH: Part of S302	
S302B		SWITCH: Part of S302	
S302C		SWITCH: Part of S302	
S302D		SWITCH: Part of S302	
S302E		SWITCH: Part of S302	
S302F		SWITCH: Part of S302	
S302G		SWITCH: Part of S302	
S302H		SWITCH: Part of S302	
S303	High voltage switch	SWITCH: SPST toggle; 25 amp	266 1040 00
S304	Low voltage switch	SWITCH: SPST toggle; 25 amp	266 1040 00
S305	600-700 v selector	SWITCH: DPDT toggle; 1 amp 250 v, 3 amp 125 v	260 0892 00
S306	Meter selector	SWITCH: Band change; 2 pole, 5 pos, 1 sect; non-shorting	259 0045 00
S306A		SWITCH: Part of S306	

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S306B		SWITCH: Part of S306	
S307		SWITCH: SPST toggle; 3 amp 250 v	260 0857 00
S401	PA plate circuit	SWITCH: Band change; 2 pole, 5 pos, 1 sect; shorting	259 0043 00
S401A		SWITCH: Part of S401	
S401B		SWITCH: Part of S401	
S402	Antenna loading	SWITCH: Band change; 6 position, shorting type	269 1248 00
T201	Modulator input	TRANSFORMER: Driver; pri; 12,000 ohm, sec: 5300 ohm CT, freq resp 300-3500 cps p/m 3 db	667 0011 00
T202	Modulation	TRANSFORMER: Mod; pri: 7000 ohm CT, 100 ma DC max, bal; sec: 500/3750 ohm, 200 ma DC, unbal; freq. resp 300/3500 cps p/m 3 db; 60 w	667 0010 00
T301	Low voltage	TRANSFORMER: Power; pri: 115 v, sec #1: 850 v CT; sec #2: 5 v, 4 amp; sec #3: 5 v, 4 amp; sec #4; 6.3 v, 9 amp 50/60 cps	662 0009 00
T302	High voltage	TRANSFORMER: Power; 50/60 cps; pri: 115 v; sec: 1100 v CT, w/pri leads #1 and #2 on 115 v, sec leads #4 and #6 should be 1370 v rms	662 0014 00
V101	Buffer amp.	TUBE: Type 6AK6; power amp pentode; miniature	254 0632 00
V102	1st multiplier	TUBE: Type 6AG7; video power amp pentode	254 0120 00
V103	2nd multiplier	TUBE: Type 7C5; beam power amp; octalox	254 0217 00
V104	3rd multiplier	TUBE: 7C5; beam power amp; octalox	254 0217 00
V105	Power amplifier	TUBE: Type RK-4D32; tetrode	256 0073 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
V106		TUBE: OA2 voltage regulator	257 0052 00
V107		TUBE: OB2 voltage regulator	257 0058 00
V201	1st and 2nd audio	TUBE: Type 6SL7GT; twin-triode amp	254 0187 00
V202	Audio driver	TUBE: Type 6SN7GT; twin-triode amp	254 0188 00
V203	Modulator	TUBE: Type 807, transmitting beam power amp	254 0391 00
V204	Modulator	TUBE: Type 807; transmitting beam power amp	254 0391 00
V205	Sidetone oscillator	TUBE: Type 6SL7GT; twin-triode amp	254 0187 00
V301	Low voltage rectifier	TUBE: Type 5Z4; full wave hi-vac rect	254 0110 00
V302	High voltage rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	254 0099 00
V303	High voltage rectifier	TUBE: Type 5R4GY; full-wave hi-vac rect	254 0099 00
V304	Bias voltage regulator	TUBE: Type OA3/VR-75; voltage regulator	257 0008 00
V305	Screen voltage limiter	TUBE: Type OA2; voltage limiter	257 0052 00
V306	Screen voltage limiter	TUBE: Type OA2; voltage limiter	257 0052 00
XV101	Socket for V101	SOCKET, TUBE: Miniature shielded	220 1003 00
XV102	Socket for V102	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV103	Socket for V103	SOCKET, TUBE: Loktal, bakelite	220 1002 00
XV104	Socket for V104	SOCKET, TUBE: Loktal, bakelite	220 1002 00
XV105	Socket for V105	SOCKET, TUBE: 7 prong ceramic w/clips	220 1072 00
XV106		SOCKET, TUBE: Miniature shielded	220 1003 00
XV107		SOCKET, TUBE: Miniature shielded	220 1003 00
XV201	Socket for V201	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV202	Socket for V202	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV203	Socket for V203	SOCKET, TUBE: 5 prong ceramic w/clips	220 5520 00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XV204	Socket for V204	SOCKET, TUBE: 5 prong ceramic w/clips	220 5520 00
XV205	Socket for V205	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV301	Socket for V301	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV302	Socket for V302	SOCKET, TUBE: Octal ceramic w/clips and keyway	220 5810 00
XV303	Socket for V303	SOCKET, TUBE: Octal ceramic w/clips and keyway	220 5810 00
XV304	Socket for V304	SOCKET, TUBE: Octal, bakelite	220 1850 00
XV305	Socket for V305	SOCKET, TUBE: Miniature, 7 term	220 1003 00
XV306	Socket for V306	SOCKET, TUBE: Miniature, 7 term	220 1003 00
XF301	Holder for F301	HOLDER, FUSE: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XF302	Holder for F302	HOLDER, FUSE: Extractor post for 1/4" x 1-1/4" fuses	265 1002 00
XI301	Mtg for I301	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
XI302	Mtg for I302	MTG, PILOT LIGHT: Bracket for candelabra base bulb	262 1320 00
	Jewel for I302	JEWEL: Pilot light; red faceted	262 2110 00

The 70E-8A oscillator used in this equipment has been dehydrated and hermetically sealed. If servicing is required it should be returned to the Collins Radio Company